Service Manual

2CX & VARIANTS

Backhoe Loader

From M/c No. 930000 Onwards

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Introduction

This publication is designed for the benefit of JCB Distributor Service Engineers who are receiving, or have received, training by JCB Technical Training Department.

These personnel should have a sound knowledge of workshop practice, safety procedures, and general techniques associated with the maintenance and repair of hydraulic earthmoving equipment.

Renewal of oil seals, gaskets, etc., and any component showing obvious signs of wear or damage is expected as a matter of course. It is expected that components will be cleaned and lubricated where appropriate, and that any opened hose or pipe connections will be blanked to prevent excessive loss of hydraulic fluid and ingress of dirt. Finally, please remember above all else **SAFETY MUST COME FIRST!**

The manual is compiled in sections, the first three are numbered and contain information as follows:

1 = **General Information** - includes torque settings and service tools.
2 = **Care & Safety** - includes warnings and cautions pertinent to aspects of workshop procedures etc.
3 = **Routine Maintenance** - includes service schedules and recommended lubricants for all the machine.

The remaining sections are alphabetically coded and deal with Dismantling, Overhaul etc. of specific components, for example:

A = **Attachments**
B = **Body & Framework** ...etc.

The page numbering in each alphabetically coded section is not continuous. This allows for the insertion of new items in later issues of the manual.

Section contents, technical data, circuit descriptions, operation descriptions etc are inserted at the beginning of each alphabetically coded section.

All sections are listed on the front cover; tabbed divider cards align directly with individual sections on the front cover for rapid reference.

Where a torque setting is given as a single figure it may be varied by plus or minus 3%. Torque figures indicated are for dry threads, hence for lubricated threads may be reduced by one third.

With the exception of slewing operations 'Left Hand' and 'Right Hand' are as viewed from the rear of the machine facing forwards.

Machine Nomenclature

In this Service Manual, reference is made to machine models, e.g. 2CX, 2CXU, these are European machine model names. North American machine models have different names, the table below shows the European and the equivalent North American nomenclature.

European		North American
2CX	=	210S
2CXU	=	210SU

Colour Coding

The following colour coding, used on illustrations to denote various conditions of oil pressure and flow, is standardised throughout JCB Service publications.

- **Red** — **Full Pressure**
  Pressure generated from operation of a service. Depending on application this may be anything between neutral circuit pressure and M.R.V. operating pressure.
- **Pink** — **Pressure**
  Pressure that is above neutral circuit pressure but lower than that denoted by red.
- **Orange** — **Servo**
  Oil pressure used in controlling a device (servo).
- **Blue** — **Neutral**
  Neutral circuit pressure.
- **Green** — **Exhaust**
- **Light Green** — **Cavitation**
  Oil subjected to a partial vacuum due to a drop in pressure (cavitation).
- **Yellow** — **Lock Up**
  Oil trapped within a chamber or line, preventing movement of components (lock up).

A390940

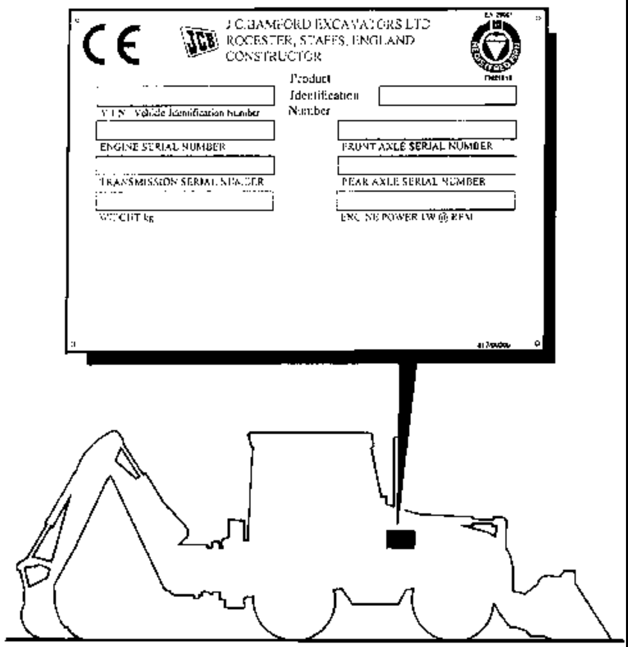
Contents

Machine Identification Plate

Your machine has an identification plate mounted on the right hand side of the machine just below the driver's cab door. The serial numbers of the machine and its major units are stamped on the plate.

The serial number of each major unit is also stamped on the unit itself. If a major unit is replaced by a new one, the serial number on the identification plate will be wrong. Either stamp the new number of the unit on the identification plate, or simply stamp out the old number. This will prevent the wrong unit number being quoted when replacement parts are ordered.

The machine and engine serial numbers can help identify exactly the type of equipment you have.



S227230

Typical Machine Identification Number

SLP	2CX	T	S	R	E	123456
A	B	C	D	E	F	G

A World Manufacturer Identification

B Machine Model

C Steer Type (T= 2WS, F=4WS)

D Build Type (S=Sideshift, C=Centremount, L=Loader)

E Year of Manufacture:
1 = 2001
2 = 2002
3 = 2003
4 = 2004
5 = 2005
6 = 2006
7 = 2007

F Manufacturer Location (E = England)

G Machine Serial Number:

Typical Engine Identification Number

AB	50262	U	500405	P
A	B	C	D	E

A Engine Type
AB = 4 cylinder turbo

B Build Number

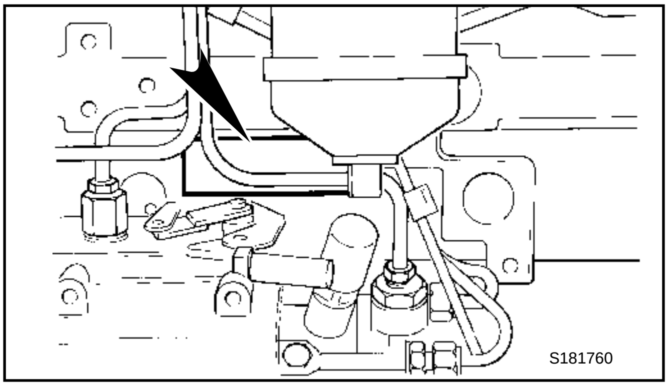
C Country of Origin

D Engine Sequence Number

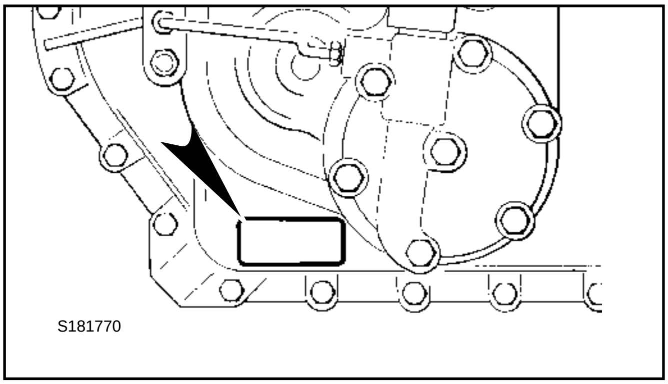
E Year of Manufacture

Unit Identification

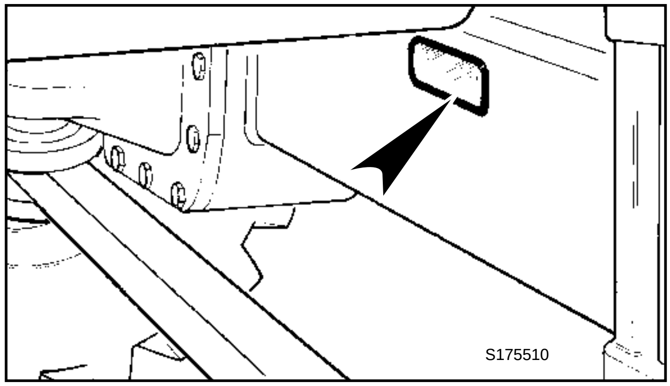
The engine serial number is stamped on a plate mounted on the left hand side of the cylinder block (looking towards the front of the machine).



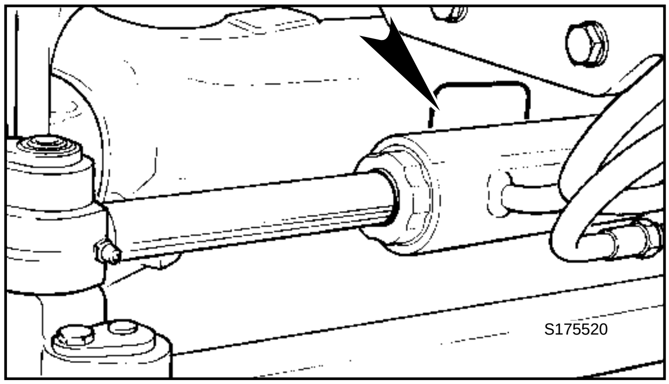
The Syncro Shuttle serial number is stamped on a label which is mounted to the rear face of the unit.



The rear axle serial number is stamped on a plate mounted to the front face of the axle, as shown below.



The front axle serial number is stamped on a plate mounted to the rear face of the axle, as shown below.



Torque Settings

Use only where no torque setting is specified in the text. Values are for dry threads and may be within three per cent of the figures stated. For lubricated threads the values should be REDUCED by one third.

UNF Grade 'S' Bolts

Bolt Size	Hexagon (A/F)		Torque Settings		
in	(mm)	in	Nm	kgf m	lbf ft
1/4	(6.3)	7/16	14	1.4	10
5/16	(7.9)	1/2	28	2.8	20
3/8	(9.5)	9/16	49	5.0	36
7/16	(11.1)	5/8	78	8.0	58
1/2	(12.7)	3/4	117	12.0	87
9/16	(14.3)	13/16	170	17.3	125
5/8	(15.9)	15/16	238	24.3	175
3/4	(19.0)	11/8	407	41.5	300
7/8	(22.2)	15/16	650	66.3	480
1	(25.4)	11/2	970	99.0	715
11/4	(31.7)	17/8	1940	198.0	1430
11/2	(38.1)	21/4	3390	345.0	2500

Metric Grade 8.8 Bolts

Bolt Size	Hexagon (A/F)		Torque Settings		
	(mm)	mm	Nm	kgf m	lbf ft
M5	(5)	8	7	0.7	5
M6	(6)	10	12	1.2	9
M8	(8)	13	28	3.0	21
M10	(10)	17	56	5.7	42
M12	(12)	19	98	10	72
M16	(16)	24	244	25	180
M20	(20)	30	476	48	352
M24	(24)	36	822	84	607
M30	(30)	46	1633	166	1205
M36	(36)	55	2854	291	2105

Note: All bolts used on JCB machines are high tensile and must not be replaced by bolts of a lesser tensile specification.

Service Tools Numerical List

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Service Tools Numerical List (cont'd)

The following parts are replacement items for kits and would normally be included in the kit numbers quoted on page 1/3-1.

Replacement item for kit no. 892/00180

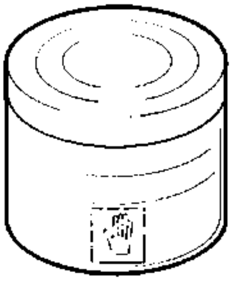
Replacement items for kit no. 892/00253

Replacement items for kit no. 993/59400

Replacement items for kit no. 993/68100

Service Tools

Section B - Body & Framework



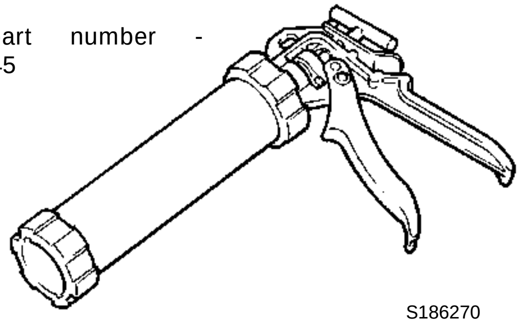
Hand Cleaner - special blend for the removal of polyurethane adhesives.

JCB part number - 4104/1310
(454g; 1 lb tub)

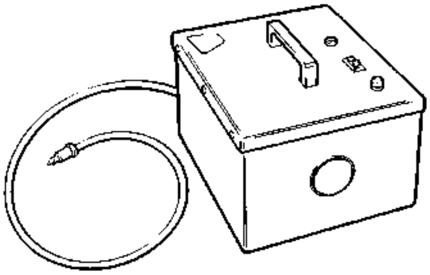
S186240

Cartridge Gun - hand operated - essential for the application of sealants, polyurethane materials etc.

JCB part number - 892/00845



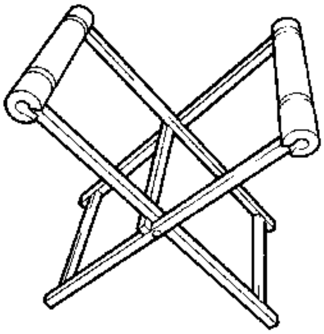
S186270



12V Mobile Oven - 1 cartridge capacity - required to pre-heat adhesive prior to use. It is fitted with a male plug (703/23201) which fits into a female socket (715/04300).

JCB part number - 992/12300

S186250



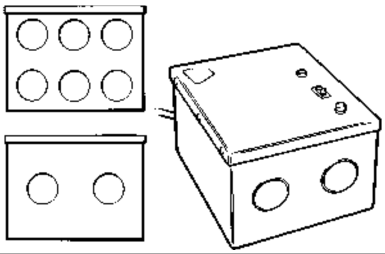
Folding Stand for Holding Glass - essential for preparing new glass prior to installation.

JCB part number - 892/00843

S186280

240V Static Oven - available with 2 or 6 cartridge capacity - required to pre-heat adhesive prior to use. No plug supplied. Note: 110V models available upon request - contact JCB Technical Service.

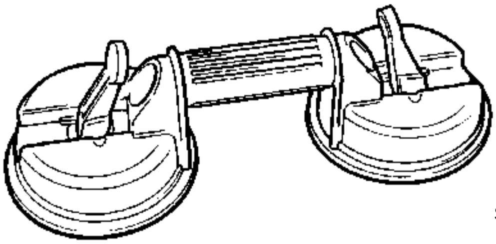
JCB part number:
992/12400 - 2 Cartridge x 240V
992/12600 - 6 Cartridge x 240V



S186260

Glass Lifter - minimum 2 off - essential for glass installation, 2 required to handle large panes of glass. Ensure suction cups are protected from damage during storage.

JCB part number - 892/00842

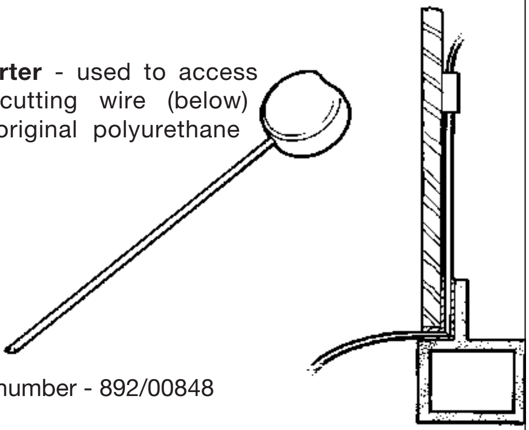


S186300

Service Tools (cont'd)

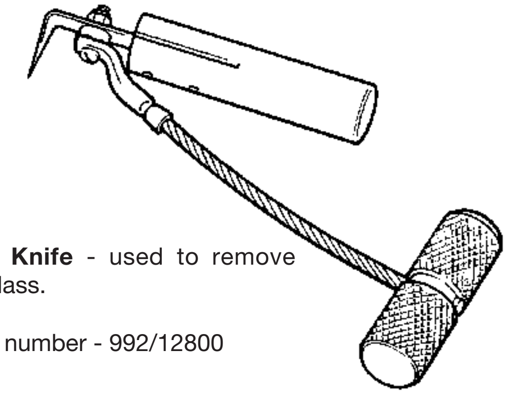
Section B - Body & Framework

Wire Starter - used to access braided cutting wire (below) through original polyurethane seal.



JCB part number - 892/00848

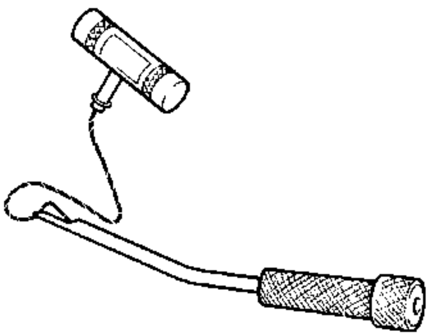
S186310



Cut-Out Knife - used to remove broken glass.

JCB part number - 992/12800

S186340



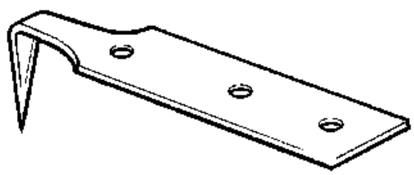
Glass Extractor (Handles) - used with braided cutting wire (below) to cut out broken glass.

JCB part number - 892/00846

S186320

'L' Blades - 25 mm (1 in) cut - replacement blades for cut-out knife (above).

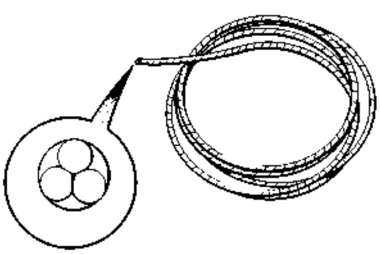
JCB part number - 992/12801 (unit quantity = 5 off)



S186350

Braided Cutting Wire - consumable heavy duty cut-out wire used with the glass extraction tool (above).

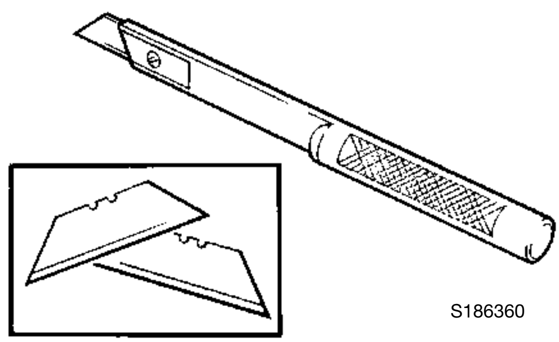
JCB part number - 892/00849
(approx 25 m length)



S186330

Long Knife - used to give extended reach for normally inaccessible areas.

JCB part number - 892/00844



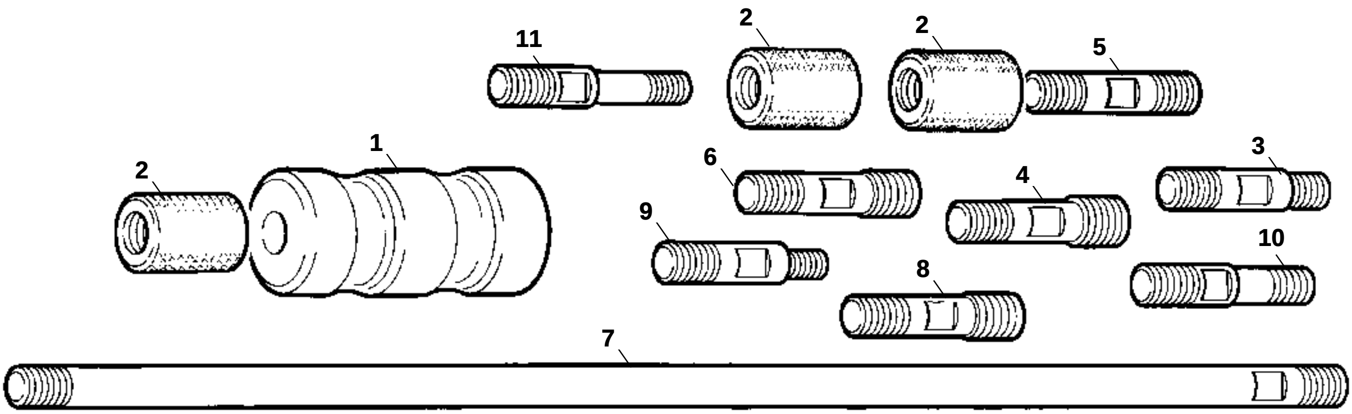
S186360

Service Tools (cont'd)

Section B - Body & Framework

Slide Hammer Kit - 993/68100

1	:993/68101	Slide Hammer	6	:993/68106	Adaptor - M20 x M24
2	:993/68102	End Stops	7	:993/68107	Bar - M20 x M20 X 800MM
3	:993/68103	Adaptor - M20 x 5/8" UNF	8	:993/68108	Adaptor - M20 x 7/8" UNF
4	:993/68104	Adaptor - M20 x 1" UNF	9	:993/68109	Adaptor - M20 x M12
5	:993/68105	Adaptor - M20 x M20	10	:993/68110	Adaptor - M20 x 5/8" UNF (Shoulder)
			11	:993/68111	Adaptor - M20 x 1/2" UNF



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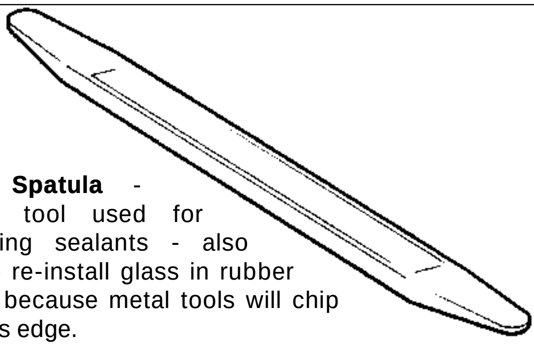
Service Tools (cont'd)

Section B - Body & Framework



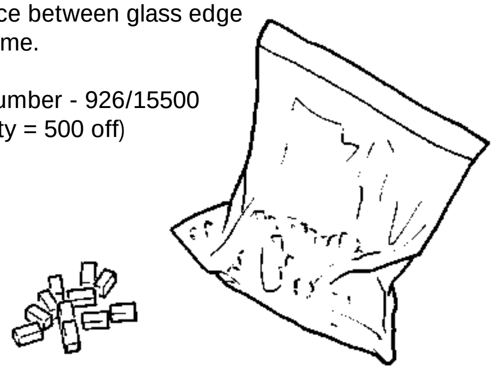
Nylon Spatula - general tool used for smoothing sealants - also used to re-install glass in rubber glazing because metal tools will chip the glass edge.

JCB part number - 892/00847

S186470

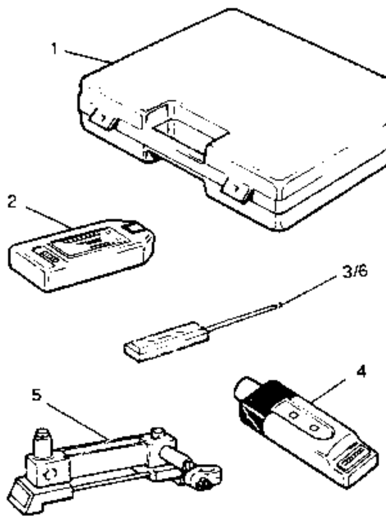
Rubber Spacer Blocks - used to provide the correct set clearance between glass edge and cab frame.

JCB part number - 926/15500
(unit quantity = 500 off)



S186550

Section C - Electrics

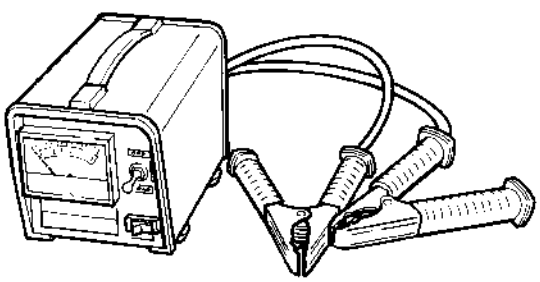


S188230

AVO Test Kit

1	892/00283	Tool Kit Case
2	892/00298	Fluke Meter 85
3	892/00286	Surface Temperature Probe
4	892/00284	Venture Microtach Digital Tachometer
5	892/00282	100 amp Shunt - open type
6	892/00285	Hydraulic Temperature Probe

993/85700 Battery Tester



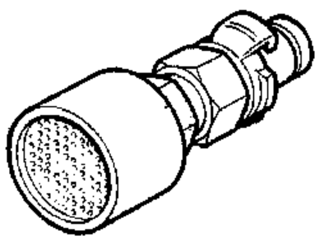
Wiring Harness Repair Tools

1	892/00350	Butane Heater Assembly
2	892/00349	Crimp Tool
3	892/00351	Splice 0.5 - 1.5mm (Red)
4	892/00352	Splice 1.5 - 2.5mm (Blue)
5	892/00353	Splice 3.0 - 6.0mm (Yellow)

Service Tools (cont'd)

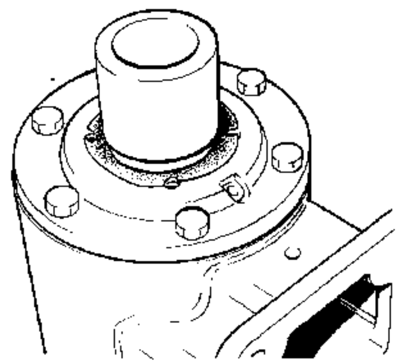
Section A - Attachments (Airmaster Compressor)

892/00877 Airmaster, Air Test Silencer - safety device, attach to air delivery cocks when cocks are to be opened with no hose attached.



S254270

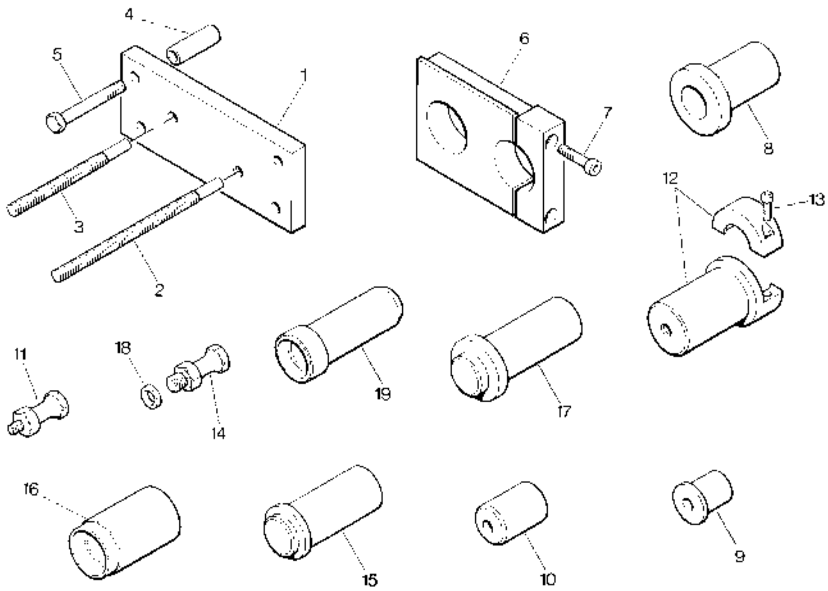
892/00878 Airmaster, Diaphram Assembly Tool - Suction Unloader, tool shown in position



S251870

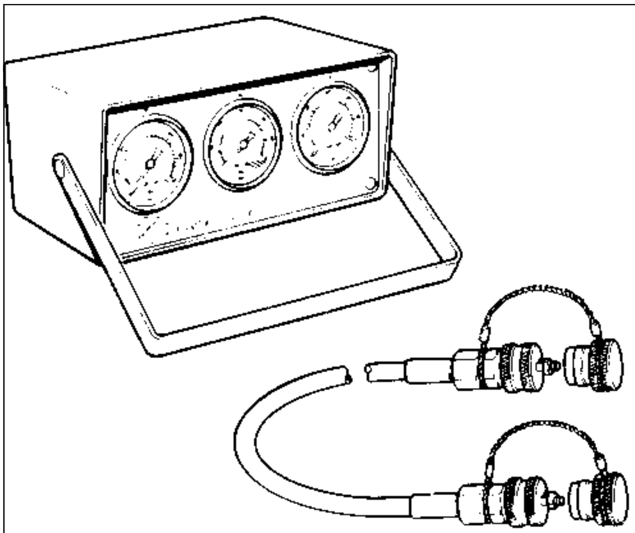
Airmaster Compressor Service Tool Kit

1 Plate - Bearing and Rotor Removal
2 Stud (long) - Bearing and Rotor Removal
3 Stud (short) - Bearing and Rotor Removal
4 Spacer (Plate) - Bearing and Rotor Removal
5 Bolt (M8 X 110)
6 Clamp - Rotor Locking
7 Screw (M10 X 45)
8 Bridge - Rotor Assembly
9 Extractor - Ball Bearing
10 Clamp - Seal Assembly Tool
11 Sling Pin - R.H.
12 Puller - Inner Bearing and Sleeve
13 Screw (M8 X 25)
14 Sling Pin - L.H.
15 Drift - Oil Seal
16 Drift - Oil Seal
17 Drift - Roller Bearing
18 Washer - Sling Pin L.H.
19 Drift - Roller Bearing - Inner



Service Tools (cont'd)

Section E - Hydraulics



Hydraulic Circuit Pressure Test Kit

892/00253 Pressure Test Kit

892/00201 Replacement Gauge 0-20 bar (0-300 lbf/in^2)

892/00202 Replacement Gauge 0-40 bar (0-600 lbf/in^2)

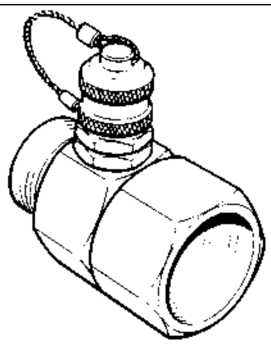
892/00203 Replacement Gauge 0-400 bar (0-6000 lbf/in^2)

892/00254 Replacement Hose

892/00347 Gauge Connector

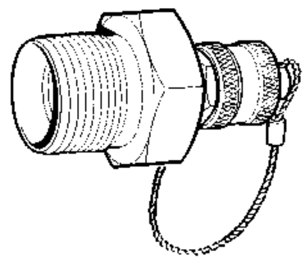
S188120

S188130



Pressure Test 'T' Adapters

892/00262	1/4 in M BSP x 1/4 in F BSP x Test Point
816/55038	3/8 in M BSP x 3/8 in F BSP x Test Point
816/55040	1/2 in M BSP x 1/2 in F BSP x Test Point
892/00263	5/8 in M BSP x 5/8 in F BSP x Test Point
892/00264	3/4 in M BSP x 3/4 in F BSP x Test Point
892/00265	1 in M BSP x 1 in F BSP x Test Point



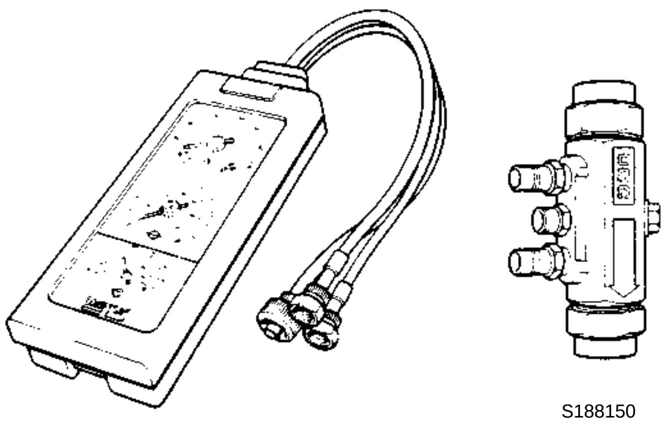
Pressure Test Adapters

892/00255	1/4 in BSP x Test Point
892/00256	3/8 in BSP x Test Point
892/00257	1/2 in BSP x Test Point
892/00258	5/8 in BSP x Test Point
816/15118	3/4 in BSP x Test Point
892/00259	1 in BSP x Test Point
892/00260	1.1/4 in BSP x Test Point
892/00261	5/8 in UNF x Test Point

S200140

Flow Test Equipment

892/00268	Flow Monitoring Unit
892/00269	Sensor Head 0 - 100 l/min (0 - 22 UK gal/min)
892/00270	Load Valve
1406/0021	Bonded Washer
1604/0006	Adapter 3/4 in M x 3/4 in M BSP
1612/0006	Adapter 3/4 in F x 3/4 in M BSP
892/00271	Adapter 3/4 in F x 5/8 in M BSP
892/00272	Adapter 5/8 in F x 3/4 in M BSP
816/20008	Adapter 3/4 in F x 1/2 in M BSP
892/00275	Adapter 1/2 in F x 3/4 in M BSP
892/00276	Adapter 3/4 in F x 3/8 in M BSP
892/00277	Adapter 3/8 in F x 3/4 in M BSP

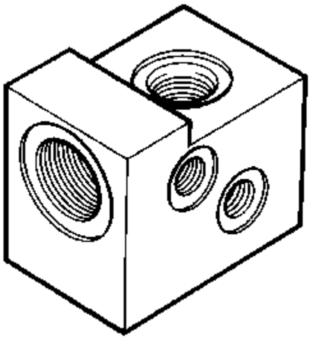


S188150

Service Tools (cont'd)

Section E - Hydraulics

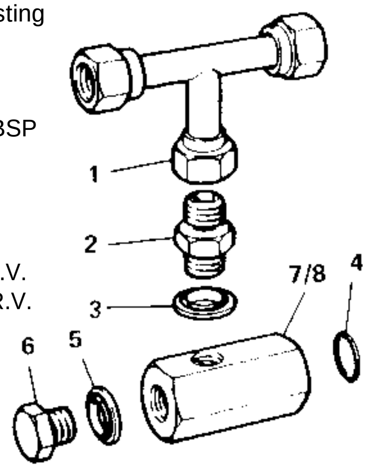
892/00252 Test Block for A.R.V.



S220840

Tool Components for Hamworthy A.R.V. testing

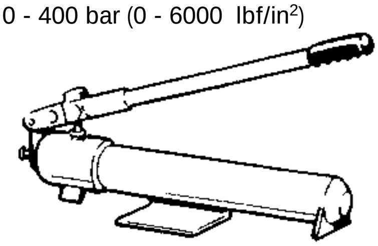
1	992/02400	Tee-piece
2	1606/0003	Adapter 3/8 in. x 1/4 in. BSP
3	1406/0011	Bonded Washer
4	2401/0103	'O' Ring
5	1406/0018	Bonded Washer
6	992/01003	Plug
7	992/10200	Body for Hamworthy A.R.V.
8	892/00153	Test Block Excavator A.R.V.



S230730

Hand Pump Equipment

892/00223	Hand Pump
892/00137	Micro-bore Hose 1/4 in BSP x 5 metres
892/00274	Adapter 1/4 in M BSP x 3/8 in M BSP Taper
892/00262	1/4 in M BSP x 1/4 in F BSP x Test Point
892/00706	Test Probe
892/00278	Gauge 0 - 40 bar (0 - 600 lbf/in^2)
892/00279	Gauge 0 - 400 bar (0 - 6000 lbf/in^2)



S193850

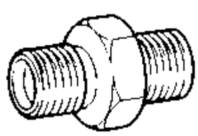
S188140

Bonded Washers

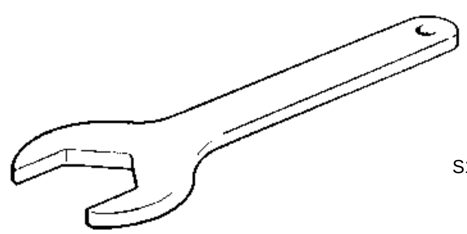
1406/0011	1/4 in BSP
1406/0018	1/2 in BSP
1406/0021	3/4 in BSP
1406/0029	1.1/4 in BSP

Male Adapters - BSP x BSP

1606/0003	3/8 in x 1/4 in
1604/0003	3/8 in x 3/8 in
1606/0004	1/2 in x 1/4 in
1606/0007	1/2 in x 3/8 in
1604/0004	1/2 in x 1/2 in
1606/0008	3/4 in x 3/8 in
1606/0009	3/4 in x 1/2 in
1604/0006	3/4 in x 3/4 in



S193860



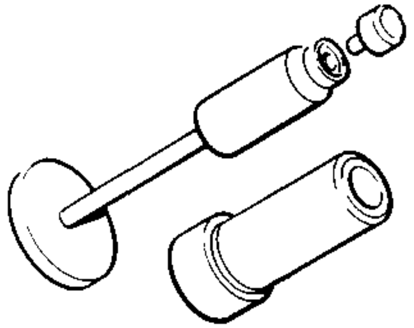
S193930

Hexagon Spanners for Ram Pistons and End Caps

992/10800	50 mm A/F
992/09300	55 mm A/F
992/09400	65 mm A/F

Service Tools (cont'd)

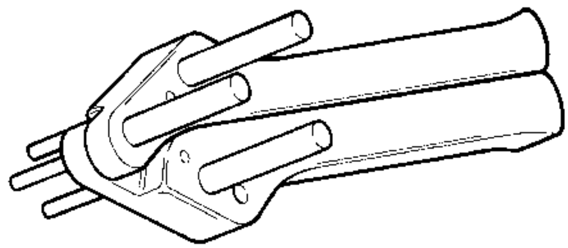
Section E - Hydraulics



S191750

892/00180 Seal Fitting Tool for fitting 'O' ring and kin ring to Danfoss Orbitrol Unit

892/00181 Replacement Plastic Boss

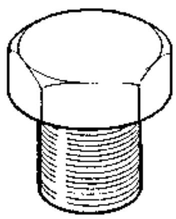


S216250

892/00334 Ram Seal Fitting Tool

Female Cone Blanking Plug

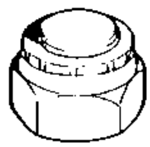
892/00055	1/4 in BSP
892/00056	3/8 in BSP
892/00057	1/2 in BSP
892/00059	3/4 in BSP
892/00060	1 in BSP



S193870

Male Cone Blanking Cap

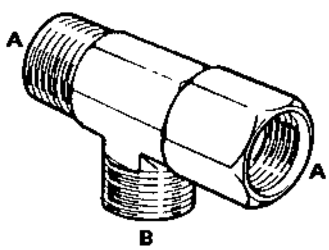
816/00294	1/4 in BSP
816/00189	3/8 in BSP
816/00190	1/2 in BSP
816/00197	5/8 in BSP
816/00196	3/4 in BSP
816/00193	1 in BSP



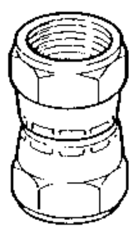
S193880

'T' Adapters

892/00047	3/8 in BSP (A) x 1/4 in BSP (B)
892/00048	1/2 in BSP (A) x 1/4 in BSP (B)
816/50043	3/4 in BSP (A) x 1/4 in BSP (B)
816/60096	3/4 in BSP (A) x 3/4 in BSP (B)



S193890



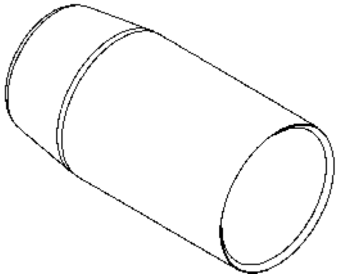
S193900

Female Connectors

892/00074	3/8 in BSP x 3/8 in BSP
892/00075	1/2 in BSP x 1/2 in BSP
892/00077	3/4 in BSP x 3/4 in BSP

Service Tools (cont'd)

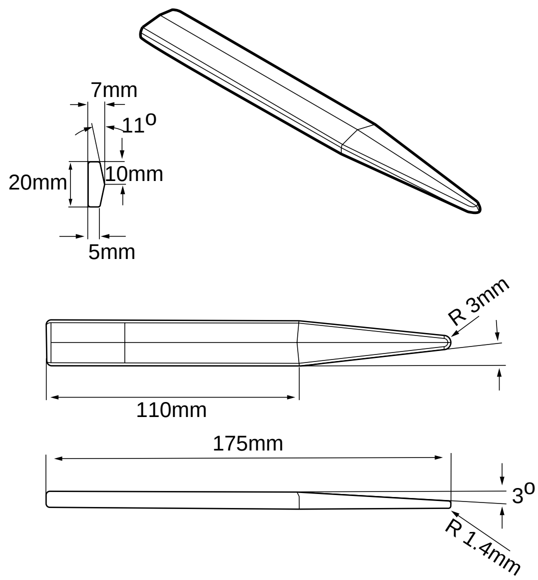
Section E - Hydraulics



Ram Seal Protection Sleeves

892/01016	For 25 mm Rod Diameter
892/01017	For 30 mm Rod Diameter
892/01018	For 40 mm Rod Diameter
892/01019	For 50 mm Rod Diameter
892/01020	For 50 mm Rod Diameter
892/01021	For 60 mm Rod Diameter
892/01022	For 60 mm Rod Diameter
892/01023	For 65 mm Rod Diameter
892/01024	For 70 mm Rod Diameter
892/01025	For 75 mm Rod Diameter
892/01026	For 80 mm Rod Diameter
892/00167	For 90 mm Rod Diameter

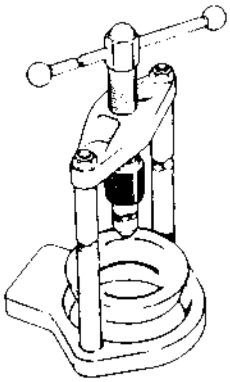
892/01027 Piston Seal Assembly Tool



Service Tools (cont'd)

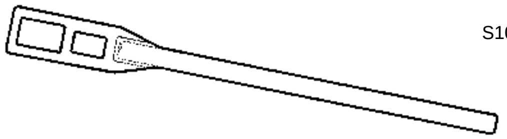
Section F - Transmission

892/00179 Bearing Press
(use with appropriate adapters)



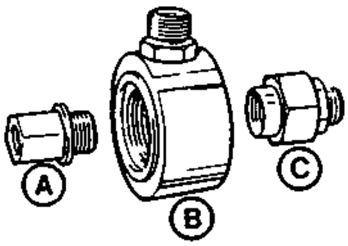
S188200

892/00812 Drive Coupling Spanner for front and rear axle yoke couplings and for 4WD output coupling on Syncro Shuttle



S107750

A 892/00304 Flow Test Adapter
B 892/00301 Flow Test Adapter
C 892/00302 Flow Test Adapter

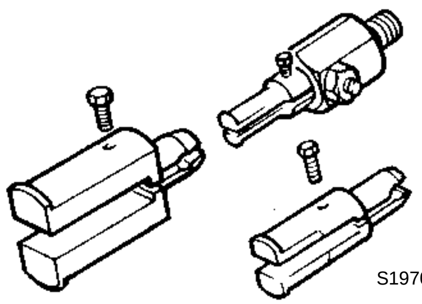


S188210

892/00225 Adapter - Impulse Extractor

Small	17mm to 25mm
Medium	25mm to 45mm
Large	45mm to 80mm

993/59500 Adapter - Impulse Extractor

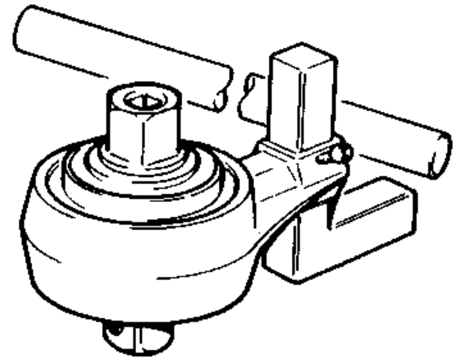


S197080

Service Tools (cont'd)

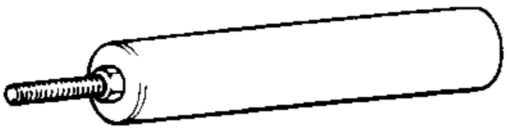
Section F - Transmission

992/04000 Torque Multiplier (use in conjunction with a torque wrench to give a 5:1 multiplication when tightening pinion nuts)



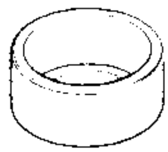
S197030

992/00800 Extractor for removing front axle pivot pin



S197050

892/00174 Measuring Cup - Pinion Head Bearing

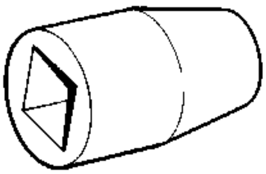


S190770

892/00224 Impulse Extractor Set for Hub Bearing Seals

S197070

892/00822 Splined Bolt Socket for driveshafts

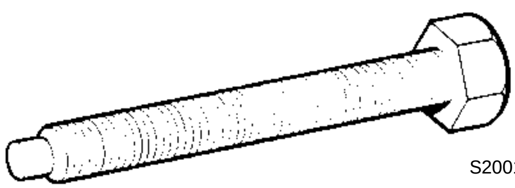


S197060

992/07609 Adapter - Steer/Drive Axle Pinion Bearing Cone

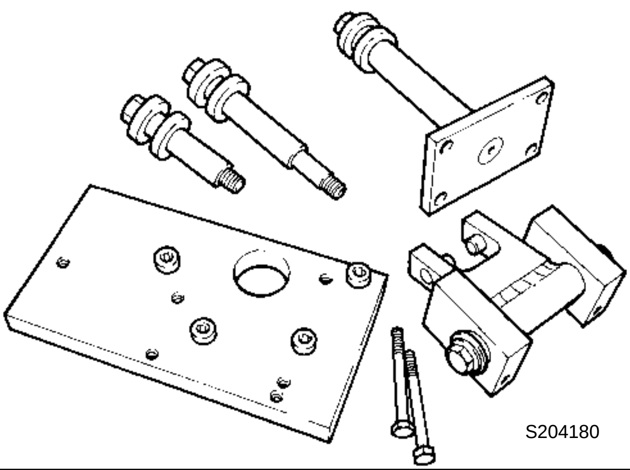
S188160

892/00833 Annulus Removal Tool



S200170

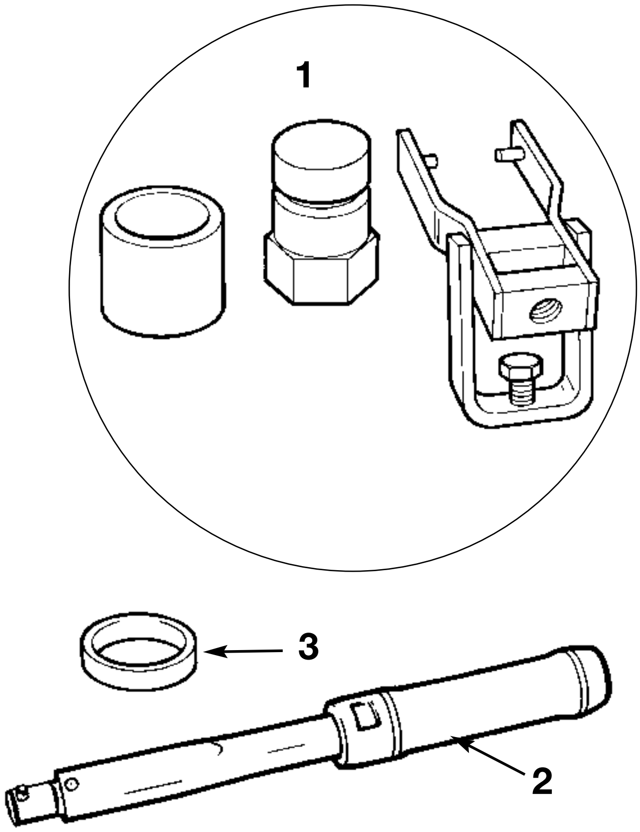
993/59400 End Float Setting Tool for gearbox:
993/59401 Base Plate
993/59402 Setting Yoke
993/59403 Mainshaft Adapter (long)
993/59404 Mainshaft Adapter (short)
993/59405 Ouput Yoke Adapter Plate
993/59406 Setting Yoke Support Pillars



S204180

Service Tools (cont'd)

Section F - Transmission

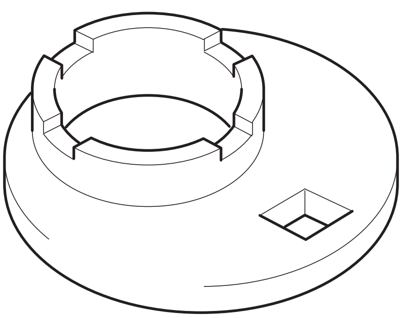


S316260

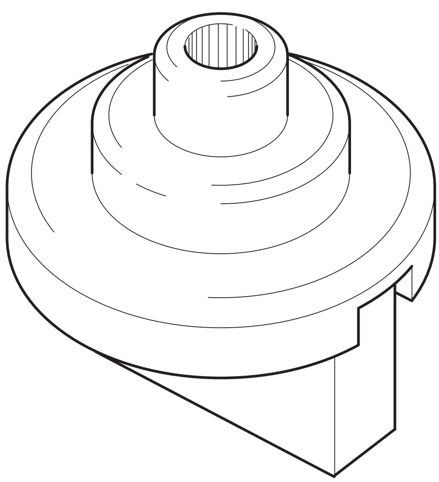
Solid Spacer Setting Kit

1	892/00918	Setting Tool Kit
2	993/70111	Breakback Torque Wrench
3	921/52600	Spacer Kit
	921/52627	Spacer 14.20 Service use
Comprises of:		
	921/52601	Spacer 12.75
	921/52602	Spacer 12.80
	921/52603	Spacer 12.85
	921/52604	Spacer 12.90
	921/52605	Spacer 12.95
	921/52606	Spacer 13.00
	921/52607	Spacer 13.05
	921/52608	Spacer 13.10
	921/52609	Spacer 13.15
	921/52610	Spacer 13.20
	921/52611	Spacer 13.25
	921/52612	Spacer 13.30
	921/52613	Spacer 13.35
	921/52614	Spacer 13.40
	921/52615	Spacer 13.45
	921/52616	Spacer 13.50
	921/52617	Spacer 13.55
	921/52618	Spacer 13.60
	921/52619	Spacer 13.65
	921/52620	Spacer 13.70
	921/52621	Spacer 13.75
	921/52622	Spacer 13.80
	921/52623	Spacer 13.85
	921/52624	Spacer 13.90
	921/52625	Spacer 13.95
	921/52626	Spacer 14.00

892/01064 Adaptor Spanner for reverser unit stake nut.


A388070

892/01065 Holding Fixture for reverser unit dismantling/assembly.

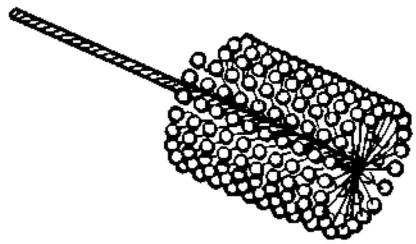

A388060

Service Tools (cont'd)

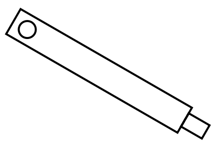
Section K - Engine

892/00041 De-glazing Tool for Cylinder Bores (to assist bedding-in of new piston rings)

Note: For other engine tools refer to the Engine Service Manual.



S192390



S216250

892/00956 Timing pin for fuel injection pump (AK, AM, AR)

Sealing and Retaining Compounds

JCB Multi-Gasket	A medium strength sealant suitable for all sizes of gasket flanges, and for hydraulic fittings of 25-65mm diameter.	4102/1212	
JCB High Strength Threadlocker	A high strength locking fluid for use with threaded components.	4102/0551	
JCB Retainer (High Strength)	For all retaining parts which are unlikely to be dismantled.	4101/0651	
JCB Threadlocker and Sealer	A high strength locking fluid for sealing and retaining nuts, bolts, and screws up to 50mm diameter, and for hydraulic fittings up to 25mm diameter.	4101/0252	
Threadseal	A medium strength thread sealing compound.	4102/1951	
Threadlocker	A locking fluid for use on threads larger than 50mm dia.	4101/0451	
Activator	A cleaning primer which speeds the curing rate of anaerobic products.	4104/0251 4104/0253	150ml 1 litre
Cleaner / Degreaser	For degreasing components prior to use of anaerobic adhesives and sealants.	4104/1557	400ml
Direct Glazing Kit	For one pane of glass, comprises items marked † below plus applicator nozzle etc.	993/55700	
† Ultra Fast Adhesive	For direct glazing	4103/2109	310 ml
† Active Wipe 205	For direct glazing	4104/1206 4104/1203	30 ml 250 g
† Black Primer 206J	For direct glazing	4201/4906	30 ml
Clear Silicone Sealant	To seal butt jointed glass	4102/0933	
Black Polyurethane Sealant	To finish exposed edges of laminated glass	4102/2309	310 ml
JCB Cleaner & Degreaser	For degreasing components prior to use of anaerobic adhesives and sealants.	4104/1538	Aerosol

Contents	**Page No.**

Safety Notices

In this publication and on the machine, there are safety notices. Each notice starts with a signal word. The signal word meanings are given below.

DANGER

Denotes an extreme hazard exists. If proper precautions are not taken, it is highly probable that the operator (or others) could be killed or seriously injured.

INT-1-2-1

WARNING

Denotes a hazard exists. If proper precautions are not taken, the operator (or others) could be killed or seriously injured.

INT-1-2-2

CAUTION

Denotes a reminder of safety practices. Failure to follow these safety practices could result in injury to the operator (or others) and possible damage to the machine.

INT-1-2-3

All construction and agricultural equipment can be hazardous. When a JCB machine is correctly operated and properly maintained, it is a safe machine to work with. But when it is carelessly operated or poorly maintained it can become a danger to you (the operator) and others.

Do not work with the machine until you are sure that you can control it.

Do not start any job until you are sure that you and those around you will be safe.

If you are unsure of anything, about the machine or the job, ask someone who knows. Do not assume anything.

Remember

BE CAREFUL
BE ALERT
BE SAFE

GEN-1-6

General Safety

⚠ WARNING

Decals

You can be injured if you do not obey the decal safety instructions. Keep decals clean. Replace unreadable or missing decals with new ones before operating the machine. Make sure replacement parts include warning decals where necessary.

INT-1-3-4

⚠ WARNING

Care and Alertness

All the time you are working with or on the machine, take care and stay alert. Always be careful. Always be alert for hazards.

INT-1-3-5

⚠ WARNING

Clothing

You can be injured if you do not wear the proper clothing. Loose clothing can get caught in the machinery. Wear protective clothing to suit the job. Examples of protective clothing are: a hard hat, safety shoes, safety glasses, a well fitting overall, ear-protectors and industrial gloves. Keep cuffs fastened. Do not wear a necktie or scarf. Keep long hair restrained.

INT-1-3-6

⚠ WARNING

Lifting Equipment

You can be injured if you use faulty lifting equipment. Make sure that lifting equipment is in good condition. Make sure that lifting tackle complies with all local regulations and is suitable for the job. Make sure that lifting equipment is strong enough for the job.

INT-1-3-7

⚠ WARNING

Raised Attachments

Raised attachments can fall and injure you. Do not walk or work under raised attachments unless they are safely blocked.

INT-1-3-8

Operating Safety

WARNING

Machine Condition

A defective machine can injure you or others. Do not operate a machine which is defective or has missing parts. Make sure the maintenance procedures in this manual are completed before using the machine.

INT-2-1-2

WARNING

Controls

You or others can be killed or seriously injured if you operate the control levers from outside the cab. Operate the control levers only when you are correctly seated inside the cab.

INT-2-1-3

WARNING

Machine Limits

Operating the machine beyond its design limits can damage the machine, it can also be dangerous. Do not operate the machine outside its limits. Do not try to upgrade the machine performance with unapproved modifications.

INT-2-1-4

WARNING

Engine/Steering Failure

If the engine or steering fails, stop the machine as quickly as possible. Do not operate the machine until the fault has been corrected.

INT-2-1-5

WARNING

Engine

The engine has exposed rotating parts. Do not open the engine cover while the engine is running. Do not use the machine with the cover open.

INT-2-1-6/1

WARNING

Entering/Leaving

Entering the cab or canopy must only be made where steps and handrails are provided. Always face the machine when entering and leaving. Make sure the step(s), handrails and your boot soles are clean and dry. Do not jump from the machine. Do not use the machine controls as handholds, use the handrails.

INT-2-1-7/1

WARNING

ROPS/FOPS Structure

The machine is fitted with a Roll Over Protection Structure (ROPS) and a Falling Objects Protection Structure (FOPS). You could be killed or seriously injured if you operate the machine with a damaged or missing ROPS/FOPS. If the ROPS/FOPS has been in an accident, do not use the machine until the structure has been renewed. Modifications and repairs that are not approved by the manufacturer may be dangerous and will invalidate the ROPS/FOPS certification.

INT-2-1-9/3

WARNING

Exhaust Gases

Breathing the machine exhaust gases can harm and possibly kill you. Do not operate the machine in closed spaces without making sure there is good ventilation. If possible, fit an exhaust extension. If you begin to feel drowsy, stop the machine at once. Get out of the cab into fresh air.

INT-2-1-10

WARNING

Communications

Bad communications can cause accidents. Keep people around you informed of what you will be doing. If you will be working with other people, make sure any hand signals that may be used are understood by everybody. Work sites can be noisy, do not rely on spoken commands.

INT-2-2-3

WARNING

Ramps and Trailers

Water, mud, ice, grease and oil on ramps or trailers can cause serious accidents. Make sure ramps and trailers are clean before driving onto them. Use extreme caution when driving onto ramps and trailers.

INT-2-2-6

DANGER

Sparks

Explosions and fire can be caused by sparks from the exhaust or the electrical system. Do not use the machine in closed areas where there is flammable material, vapour or dust.

INT-2-2-10

Maintenance Safety

⚠ WARNING

Repairs

Do not try to do repairs or any other type of maintenance work you do not understand. To avoid injury and/or damage get the work done by a specialist engineer.

GEN-1-5

⚠ WARNING

Modifications and Welding

Non-approved modifications can cause injury and damage. Parts of the machine are made from cast iron; welds on cast iron can weaken the structure and break. Do not weld cast iron. Contact your JCB distributor for advice before modifying the machine.

INT-3-1-2/1

⚠ WARNING

Metal Splinters

You can be injured by flying metal splinters when driving metal pins in or out. Use a soft faced hammer or drift to remove and fit metal pins. Always wear safety glasses.

INT-3-1-3

⚠ WARNING

Electrical Circuits

Understand the electrical circuit before connecting or disconnecting an electrical component. A wrong connection can cause injury and/or damage.

INT-3-1-4

⚠ WARNING

Communications

Bad communications can cause accidents. If two or more people are working on the machine, make sure each is aware of what the others are doing. Before starting the engine make sure the others are clear of the danger areas; examples of danger areas are: the rotating blades and belt on the engine, the attachments and linkages, and anywhere beneath or behind the machine. People can be killed or injured if these precautions are not taken.

INT-3-1-5

⚠ WARNING

Petrol

Do not use petrol in this machine. Do not mix petrol with the diesel fuel; in storage tanks the petrol will rise to the top and form flammable vapours.

INT-3-1-6

⚠ WARNING

Battery

A battery with frozen electrolyte can explode if it is used or charged. Do not use a machine with a frozen battery. To help prevent the battery from freezing, keep the battery fully charged.

INT-3-1-7

⚠ WARNING

Battery Gases

Batteries give off explosive gases. Keep flames and sparks away from the battery. Do not smoke close to the battery. Make sure there is good ventilation in closed areas where batteries are being used or charged. Do not check the battery charge by shorting the terminals with metal; use a hydrometer or voltmeter.

INT-3-1-8

⚠ WARNING

Battery Terminals

The machine is negatively earthed. Always connect the negative pole of the battery to earth.

When connecting the battery, connect the earth (-) lead last.

When disconnecting the battery, disconnect the earth (-) lead first.

INT-3-1-9

⚠ WARNING

Hydraulic Fluid

Fine jets of hydraulic fluid at high pressure can penetrate the skin. Do not use your fingers to check for hydraulic fluid leaks. Do not put your face close to suspected leaks. Hold a piece of cardboard close to suspected leaks and then inspect the cardboard for signs of hydraulic fluid. If hydraulic fluid penetrates your skin, get medical help immediately.

INT-3-1-10/1

⚠ DANGER

Hydraulic Pressure

Hydraulic fluid at system pressure can injure you. Before disconnecting or connecting hydraulic hoses, stop the engine and operate the controls to release pressure trapped in the hoses. Make sure the engine cannot be started while the hoses are open.

INT-3-1-11/1

Maintenance Safety (cont'd)

⚠ WARNING

Diesel Fuel

Diesel fuel is flammable; keep naked flames away from the machine. Do not smoke while refuelling the machine or working on the engine. Do not refuel with the engine running. There could be a fire and injury if you do not follow these precautions.

INT-3-2-2

⚠ WARNING

Oil

Oil is toxic. If you swallow any oil, do not induce vomiting, seek medical advice. Used engine oil contains harmful contaminants which can cause skin cancer. Do not handle used engine oil more than necessary. Always use barrier cream or wear gloves to prevent skin contact. Wash skin contaminated with oil thoroughly in warm soapy water. Do not use petrol, diesel fuel or paraffin to clean your skin.

INT-3-2-3

⚠ WARNING

Soft Ground

A machine can sink into soft ground. Never work under a machine on soft ground.

INT-3-2-4

⚠ WARNING

Counterweights

Your machine may be fitted with counterweights. They are extremely heavy. Do not attempt to remove them.

INT-3-2-5

⚠ WARNING

Tyres and Rims

Over-inflated or over-heated tyres can explode. Follow the instructions in this manual for inflating the tyres. Do not weld or cut rims. Get a tyre/wheel specialist to do any repair work.

INT-3-2-6

⚠ WARNING

Hot Coolant

The cooling system is pressurised when the engine is hot. Hot coolant can spray out when you remove the radiator cap. Let the system cool before removing the radiator cap. To remove the cap, turn it to the first notch and let the system pressure escape, then remove the cap.

INT-3-2-9

⚠ WARNING

Fires

If your machine is equipped with a fire extinguisher, make sure it is checked regularly. Keep it in the operator's cab until you need to use it.

Do not use water to put out a machine fire, you could spread an oil fire or get a shock from an electrical fire. Use carbon dioxide, dry chemical or foam extinguishers. Contact your nearest fire department as quickly as possible. Firefighters should use self-contained breathing apparatus.

INT-3-2-7/1

⚠ CAUTION

Rams

The efficiency of the rams will be affected if they are not kept free of solidified dirt. Clean dirt from around the rams regularly. When leaving or parking the machine, close all rams if possible to reduce the risk of weather corrosion.

INT-3-2-10

⚠ CAUTION

Cleaning

Cleaning metal parts with incorrect solvents can cause corrosion. Use only recommended cleaning agents and solvents.

INT-3-2-11

⚠ CAUTION

'O' rings, Seals and Gaskets

Badly fitted, damaged or rotted 'O' rings, seals and gaskets can cause leakages and possible accidents. Renew whenever disturbed unless otherwise instructed. Do not use Trichloroethane or paint thinners near 'O' rings and seals.

INT-3-2-12

⚠ WARNING

Jacking

A machine can roll off jacks and crush you unless the wheels have been chocked. Always chock the wheels at the opposite end of the machine that is to be jacked. Do not work underneath a machine supported only by jacks. Always support a jacked-up machine on axle stands before working underneath it.

INT-3-2-8

⚠ WARNING

Safety Strut

Raised loader arms can drop suddenly and cause serious injury. Before working under raised loader arms, fit the loader arm safety strut.

2-1-1-6

Maintenance Safety (cont'd)

WARNING

Hydraulic Hoses

Damaged hoses can cause fatal accidents. Inspect the hoses regularly for:

- Damaged end fittings
- Chafed outer covers
- Ballooned outer covers
- Kinked or crushed hoses
- Embedded armouring in outer covers
- Displaced end fittings.

INT-3-3-2

WARNING

To avoid burning, wear protective gloves when handling hot components. To protect your eyes, wear goggles when using a wire brush to clean components.

HYD 1-3

WARNING

A raised and badly supported machine can fall on you. Position the machine on a firm, level surface before raising one end. Ensure the other end is securely chocked. Do not rely solely on the machine hydraulics or jacks to support the machine when working under it.

Disconnect the battery, to prevent the engine being started while you are beneath the machine.

GEN-1-1

WARNING

Make the machine safe before working underneath it. Park the machine on level ground, lower the arms. Apply the parking brake, put the transmission in neutral and stop the engine. Chock both sides of all four wheels.

Disconnect the battery, to prevent the engine being started while you are beneath the machine.

GEN-1-2

WARNING

Waxoyl contains turpentine substitute, which is flammable. Keep flames away when applying Waxoyl. Waxoyl can take a few weeks to dry completely. Keep flames away during the drying period.

Do not weld near the affected area during the drying period. Take the same precautions as for oil to keep Waxoyl off your skin. Do not breathe the fumes. Apply in a well-ventilated area.

5-3-1-9

WARNING

Fluoroelastomeric Materials

Certain seals and gaskets (e.g. crankshaft oil seal) on JCB machines contain fluoroelastomeric materials such as Viton, Fluorel and Technoflon. Fluoroelastomeric materials subjected to high temperatures can produce highly corrosive hydrofluoric acid. THIS ACID CAN SEVERELY BURN.

New fluoroelastomeric components at ambient temperature require no special safety precautions.

Used fluoroelastomeric components whose temperatures have not exceeded 300°C require no special safety precautions. If evidence of decomposition (e.g. charring) is found, refer to the next paragraph for safety instructions. DO NOT TOUCH COMPONENT OR SURROUNDING AREA.

Used fluoroelastomeric components subjected to temperatures greater than 300°C (e.g. engine fire) must be treated using the following safety procedure. Make sure that heavy duty gloves and special safety glasses are worn:

1. Ensure that components have cooled then remove and place material into plastic bags.

2. Thoroughly wash contaminated area with 10% calcium hydroxide or other suitable alkali solution, if necessary use wire wool to remove burnt remains.

3. Thoroughly wash contaminated area with detergent and water.

4. Contain all removed material, gloves etc. used in this operation in sealed plastic bags and dispose of in accordance with Local Authority Regulations.

DO NOT BURN FLUOROELASTOMERIC MATERIALS.

If contamination of skin or eyes occurs, wash affected area with a continuous supply of clean water or with calcium hydroxide solution for 15-60 minutes. Get medical attention immediately.

INT-3-3-5/1

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Introduction

Your machine has been designed and built to give maximum performance, economy and ease of use under a wide variety of operating conditions. Prior to delivery, your machine was inspected both at the Factory and by your Distributor to ensure that it reaches you in optimum condition. To maintain this condition and ensure trouble free operation it is important that the routine services, as specified in this Handbook, are carried out by an approved JCB Distributor at the recommended intervals.

Maintenance

This section of the Handbook gives full details of the service requirements necessary to maintain your JCB machine at peak efficiency.

To further protect your machine's performance it is essential your JCB Distributor carries out an initial service and inspection when the machine is one month old or when it has completed 100 hours of operation (whichever occurs first). You should notify your Distributor in advance to allow the necessary arrangements to be made.

It can be seen from the Service Schedules on the following pages that many essential service checks should only be carried out by a JCB trained specialist. Only JCB Distributor Service Engineers have been trained by JCB to carry out such specialist tasks, and only JCB Distributor Service Engineers are equipped with the necessary special tools and test equipment to perform such tasks, thoroughly, safely, accurately and efficiently.

JCB regularly updates its Distributors advising them of any product developments, changes in specifications and procedures. Therefore only a JCB Distributor is fully able to maintain and service your machine.

Remember, if your machine has been correctly maintained, not only will it give you improved reliability but its resale value will be greatly enhanced.

Owner/Operator Support

JCB together with your Distributor wants you to be completely satisfied with your new JCB machine. If you do encounter a problem however, you should contact your Distributor's Service Department who are there to help you!

You will have been given the names of the relevant service contacts at your Distributor when the machine was installed.

To get the most from your Distributor please help them to satisfy you by:

1 Giving your name, address and telephone number.
2 Quoting your machine model and serial number.
3 Date of purchase and hours of work.
4 Nature of the problem.

Remember, only your JCB Distributor has access to the vast resources available at JCB to help support you. In addition, your Distributor is able to offer a variety of programmes covering Warranty, Fixed Price Servicing, Safety Inspections, including weight tests, covering both legal and insurance requirements:

Service/Maintenance Agreements

To help plan and spread the costs of maintaining your machine, we strongly recommend you take advantage of the many Service and Maintenance Agreements your Distributor can offer. These can be tailor made to meet your operating conditions, work schedule etc.

Please consult your JCB Distributor for details.

Lifting Regulations - Inspections and Tests

Only your JCB Distributor can fully meet the requirements of the inspection and test parameters to suit UK Health & Safety Executive (H.S.E.) legal requirements along with providing Annual Inspections to meet your Insurance Company Policy conditions.

Only your JCB Distributor has the ability to meet the definition described covering a "Competent Person" to carry out these necessary tests and inspections. This ensures that only JCB Factory trained, experienced and up-to-date Engineers supported with all of the available data and material provided only to a JCB Distributor will ensure a thorough and reliable standard.

It is most important that you read and understand this information and the publications referred to. Make sure all your colleagues who are concerned with lubricants read it too.

Hygiene

JCB lubricants are not a health risk when used properly for their intended purposes.

However, excessive or prolonged skin contact can remove the natural fats from your skin, causing dryness and irritation.

Low viscosity oils are more likely to do this, so take special care when handling used oils, which might be diluted with fuel contamination.

Whenever you are handling oil products you should maintain good standards of care and personal and plant hygiene. For details of these precautions we advise you to read the relevant publications issued by your local health authority, plus the following.

Storage

Always keep lubricants out of the reach of children.

Never store lubricants in open or unlabeled containers.

Handling

New Oil

There are no special precautions needed for the handling or use of new oil, beside the normal care and hygiene practices.

Used Oil.

Used engine crankcase lubricants contain harmful contaminants.

Here are precautions to protect your health when handling used engine oil:

1 Avoid prolonged, excessive or repeated skin contact with used engine oils.

2 Apply a barrier cream to the skin before handling used engine oil.

3 Note the following when removing engine oil from skin:

- **a** Wash your skin thoroughly with soap and water.
- **b** Using a nail brush will help.
- **c** Use special hand cleansers to help clean dirty hands.
- **d** Never use petrol, diesel fuel, or paraffin for washing.
- **e** Avoid skin contact with oil soaked clothing.
- **f** Don't keep oily rags in pockets.
- **g** Wash dirty clothing before re-use.
- **h** Throw away oil-soaked shoes.

First Aid - Oil

Eyes
In the case of eye contact, flush with water for 15 minutes. If irritation persists, get medical attention.

Swallowing
If oil is swallowed do not induce vomiting. Get medical advice.

Skin
In the case of excessive skin contact, wash with soap and water.

Spillage

Absorb on sand or a locally approved brand of absorbent granules. Scrape up and remove to a chemical disposal area.

Fires

Extinguish with carbon dioxide, dry chemical or foam. Fire-fighters should use self-contained breathing apparatus.

Waste Disposal

All waste products should be disposed of in accordance with all the relevant regulations.

The collection and disposal of used engine oil should be in accordance with any local regulations. Never pour used engine oil into sewers, drains or on the ground.

A badly maintained machine is a danger to the operator and the people working around him. Make sure that the regular maintenance and lubrication jobs listed in the service schedules are done to keep the machine in a safe and efficient working condition.

Apart from the daily jobs, the schedules are based on machine running hours. Keep a regular check on the hourmeter readings to correctly gauge service intervals. Do not use a machine which is due for a service. Make sure any defects found during the regular maintenance checks are rectified immediately.

⚠ WARNING

Maintenance

Maintenance must be done by suitably qualified personnel. Before attempting any maintenance work, make sure the machine is safe. Park on level ground. If it is necessary to work with the loader arms raised, then the loader arm safety strut must be fitted as shown in Loader Arm Safety Strut in MAINTENANCE section.

2-3-1-1

Calendar equivalents:

10 Hours = Daily	50 Hours = Weekly	500 Hours = Six Months
1000 Hours = Yearly	2000 Hours = 2 Years	

Pre-start Cold Checks Service Points and Fluid Levels	**Operation**	**10 Hr**	**50 Hr**	**†100 Hr**	**500 Hr**	**1000 Hr**	**2000 Hr**
ENGINE							
Engine Mount Security ③	- Check			•	•	•	•
Oil Level	- Check	•	•				
Oil and Filter ④	- Change			•	•	•	•
Fuel Filter	- Change			•	•	•	•
Air Cleaner Dust Valve	- Clean				•	•	•
Air Cleaner Outer Element ⑥	- Change				•	•	•
Air Cleaner Inner Element	- Change						•
Valve Clearances ③	- Check and Adjust						•
External Oil Leaks	- Check	•	•	•	•	•	•
Fan Belt Tension/Condition	- Check		•	•	•	•	•
Fuel Sedimenter and Filter	- Drain		•	•	•	•	•
Coolant Level and Antifreeze Strength	- Check	•	•	•	•	•	•
Pre-cleaner	- Clean (if fitted)	•	•	•	•	•	•
Radiator Hose - Condition	- Check			•	•	•	•
TRANSMISSION AND AXLES							
Drive/Steer Axle Oil Level ①	- Check			•			
Drive/Steer Axle Oil	- Change				•	•	•
Steer Hub Oil Level ① ⑧	- Check			•			
Steer Hub Oil	- Change			•	•	•	•
Drive Shafts (including P.T.O. if fitted)	- Security/Grease		•	•	•	•	•
Oil Filter	- Change			•	•	•	•
Steering Swivels	- Grease				•	•	•
Transmission Oil Level	- Check	•	•	•	•		
Transmission Oil ⑦	- Change					•	•
Axles/Hubs/Transmission for Leaks ①	- Check	•	•		•	•	•
Power Take Off Gearbox (if fitted) for Leaks/Oil Level ①	- Check	•	•		•	•	•
Power Take Off Gearbox Oil (if fitted)	- Change			•		•	•
Steer Axle Pivots and Linkages	- Grease/Check	•	•	•	•	•	•
Tyre Pressures/Condition	- Check	•	•	•	•	•	•
Wheel Nut Security ⑤	- Check	•	•	•	•	•	•

Pre-start Cold Checks Service Points and Fluid Levels	**Operation**	**10 Hr**	**50 Hr**	**†100 Hr**	**500 Hr**	**1000 Hr**	**2000 Hr**
HYDRAULICS							
Oil Filter	- Change			•	•	•	•
Oil Level ②	- Check	•	•	•	•	•	
Oil	- Sample/Change						•
Suction Strainer	- Clean						•
Hydraulic System for Leaks (Hoses etc.)	- Check		•		•	•	•
Rod/Rams - Condition	- Check				•	•	•
ELECTRICS							
Battery Electrolyte Level	- Check			•	•	•	•
Wiring for Chafing	- Check		•	•	•	•	•
Battery Terminals for Condition and Tightness	- Check		•	•	•	•	•
BRAKES							
Brake System Fluid Level	- Check	•	•	•	•	•	•
Brake System Fluid ③	- Change						•
Parking Brake	- Check and Adjust			•	•	•	•
BODYWORK AND FRAMEWORK							
All Pivot Points	- Grease/Check	•	•	•	•	•	•
All Mounting Bolts for Tightness ③	- Check			•	•	•	•
All Hinges	- Lubricate			•	•	•	•
All Cables	- Lubricate			•	•	•	•
All Slides/Control Levers	- Lubricate			•	•	•	•
Extradig Dipper Wear Pads	- Check and Grease		•	•	•	•	•
CAB							
ROPS/FOPS	- Check					•	•
Heater Filter	- Clean (if fitted)				•	•	•
Windscreen Washer Fluid Level	- Check	•	•	•	•	•	•
ATTACHMENTS							
Optional Equipment (as required)	- Check		•	•	•	•	•

Functional Test and Final Inspection	**Operation**	**10 Hr**	**50 Hr**	**†100 Hr**	**500 Hr**	**1000 Hr**	**2000 Hr**
ENGINE							
Idle Speed ③	- Check and Adjust			•	•	•	•
Stall Speed ③	- Check Pull Down			•	•	•	•
Max. No Load Speed ③	- Check and Adjust				•	•	•
Exhaust System Security ③	- Check			•	•	•	•
Air Inlet System Security	- Check			•	•	•	•
Fuel System for Leaks and Contamination	- Check		•	•	•	•	•
Coolant System for Leaks and Contamination	- Check			•	•	•	•
Throttle System and Control Cable ③	- Check			•	•	•	•
Exhaust Smoke (excessive)	- Check		•	•	•	•	•
TRANSMISSION AND AXLES AND STEERING							
Torque Converter Mainline Pressure ③	- Check			•	•	•	•
Clutch Pack Pressure ③	- Check			•	•	•	•
Forward/Reverse - Selection/Operation	- Check			•	•	•	•
Oil Cooler and Pipework	- Check			•	•	•	•

Functional Test and Final Inspection	Operation	10 Hr	50 Hr	†100 Hr	500 Hr	1000 Hr	2000 Hr
HYDRAULICS							
MRV Pressure ③	- Check and Adjust			•	•	•	•
Steer Circuit MRV ③	- Check and Adjust			•	•	•	•
Hose Burst Protection Valves	- Check (if fitted)			•	•	•	•
Operation All Services	- Check	•	•	•	•	•	•
Road Wheel Alignment	- Check	•	•		•	•	•
Steer Circuit Operation	- Check	•	•	•	•	•	•
ELECTRICS							
Operate All Electrical Equipment	- Check	•	•	•	•	•	•
Warning Lights	- Check	•	•	•	•	•	•
Lights and Instruments	- Check	•	•	•	•	•	•
Air Conditioning (if fitted)	- Check	•	•	•	•	•	•
Starter Motor	- Check			•			
Alternator - Output	- Check			•			
Wipers	- Check	•	•	•			
Heater	- Check	•	•	•			
BRAKES							
Foot Brake - Operation	- Check	•	•	•	•	•	•
Parking Brake - Operation	- Check	•	•	•	•	•	•
Servo Operation (if fitted)	- Check			•	•	•	•
BODYWORK AND FRAMEWORK							
Teeth and Side cutters - Security	- Check			•			
CAB							
Seat/Seat Belt	- Check	•	•	•	•	•	•
Glazing for Correct Fit	- Check			•			
Locks and Keys	- Check			•			
Tool Kit and Handbooks	- Check			•			
PAINTWORK							
Condition -	- Check			•			
ATTACHMENTS							
Attachment Circuit Pressures ③	- Check			•	•	•	•
Attachment Operation	- Check		•	•			

† **Note:** First 100 Hours Service only or following major repair, to be completed by your JCB Distributor.

① **Note:** Check for leaks every 50 hours, check level if leaking.

② **Note:** Check the hydraulic fluid level with the loader and backhoe in the travel position.

③ **Note:** Jobs which should only be done by a specialist are indicated by a ③.

④ **Note:** If operating under arduous conditions, change the engine oil filter every 250 hours.

⑤ **Note:** Check tightness of wheel nuts every day for first week (when machine is new), thereafter every 50 hours.

⑥ **Note:** Change outer element if warning 'Air Filter Blocked' alarm sounds. A new inner element must be fitted at latest every third time the outer element is changed.

⑦ **Note:** After a major transmission repair, the new oil should be run to operating temperature and changed again to remove any contamination which entered during repair. Change the oil and filter after a further 100 hours if the oil was heavily contaminated because of, or from the failure (eg. water contamination).

⑧ **Note:** After a hub repair, the new oil should be run to operating temperature and changed again to remove any contamination which entered during the repair. Change the oil again after a further 100 hours to remove any bedding-in wear. This is particularly important if new brake plates have been fitted.

⚠ WARNING

Raised loader arms can drop suddenly and cause serious injury. Before working under raised loader arms, fit the loader arm safety strut.
2-1-1-6

Installing

1 Empty the Shovel and Raise the Loader Arms Fully.

2 Stop the Engine
Remove the starter key.

⚠ WARNING

You could be killed or injured if the loader control is accidentally operated. Make sure no-one comes near the machine while you release the safety strut.
2-3-1-2

3 Release the Strut

a Open fastener **A**.
b Remove strut **B.**

4 Install the Strut

a Push strut **B** over the ram piston rod.
b Secure the strut in position with strap **C**.

5 Lower the Arm Onto the Strut

To prevent any chance of the loader arms creeping down and trapping your fingers, the loader arms should be carefully lowered onto the safety strut as shown.

Start the engine and slowly lower the loader arms onto the safety strut, stop the movement immediately the weight of the loader arms is supported by the safety strut.

Note: When lowering the loader, operate the control lever carefully. 'Feather' the lever to lower the loader very slowly.

Removing

1 Fully Raise the Loader Arms

To take the weight off the safety strut.

2 Stop the Engine

Remove the starter key.

⚠ WARNING

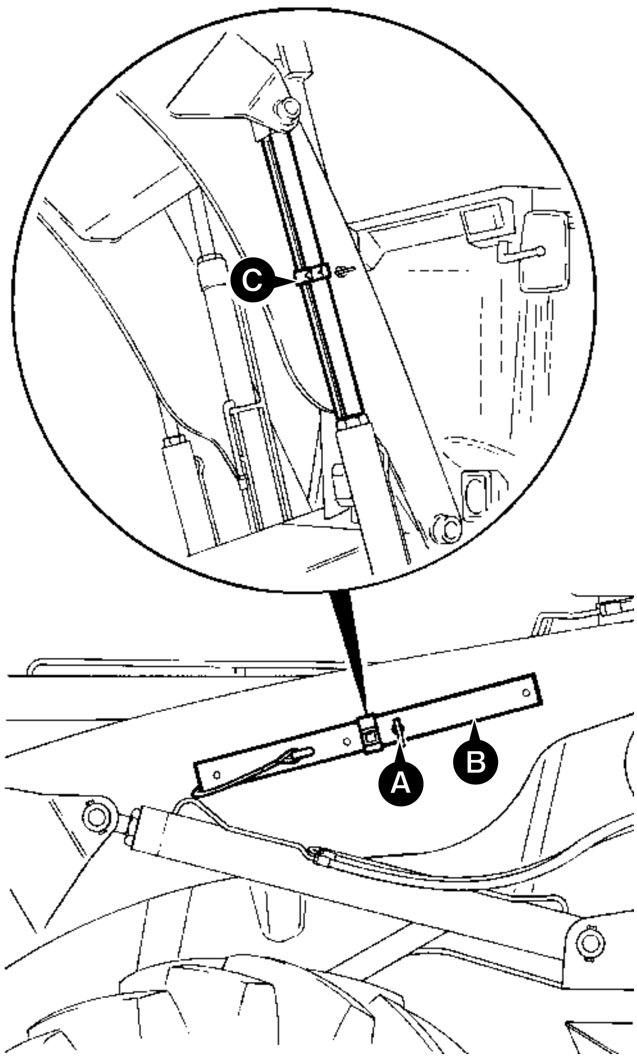
You could be killed or injured if the loader control is accidentally operated. Make sure no-one comes near the machine while you remove the safety strut.
2-3-1-3

3 Remove the Strut

a Undo strap **C**.
b Remove strut **B** from the ram piston rod.

4 Stow the Strut

a Stow strut **B** onto the loader arm.
b Secure strut **B** onto the loader arm with fastener **A**.



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Checking for Damage

Inspect steelwork for damage. Note damaged paintwork for future repair.

Make sure all pivot pins are correctly in place and secured by their locking devices.

Ensure that the steps and handrails are undamaged and secure.

Check for broken or cracked window glass. Replace damaged items.

Check all bucket teeth for damage and security.

Check all lamp lenses for damage.

Inspect the tyres for damage and penetrating by sharp objects.

Check that all safety decals are in place and undamaged, fit new decals where necessary (refer to Operator Handbook - **Safety Decals**).

Cleaning the Machine

Park the machine on firm level ground, engage the parking brake and set the transmission to neutral. Lower the backhoe and loader end to the ground and stop the engine.

⚠ WARNING

Airborne particles of light combustible material such as straw, grass, wood shavings, etc. must not be allowed to accumulate within the engine compartment or in the propshaft guards (when fitted). Please inspect these areas frequently and clean at the beginning of each work shift or more often if required. Before raising the engine cover, ensure that the top is clear of debris.

5-3-1-12/1

Clean the machine using water and/or steam. Pay particular attention to the underside. Do not allow mud to build up on the engine and transmission. Make sure the radiator grille is not clogged up. Remove debris from the kingpost mounting rails.

It is important to note that excessive power washing can cause damage to the seals or bearings. Take care during routine machine washing not to direct high power water jets directly at oil seals or universal joints.

Note: The machine must always be greased after pressure washing or steam cleaning.

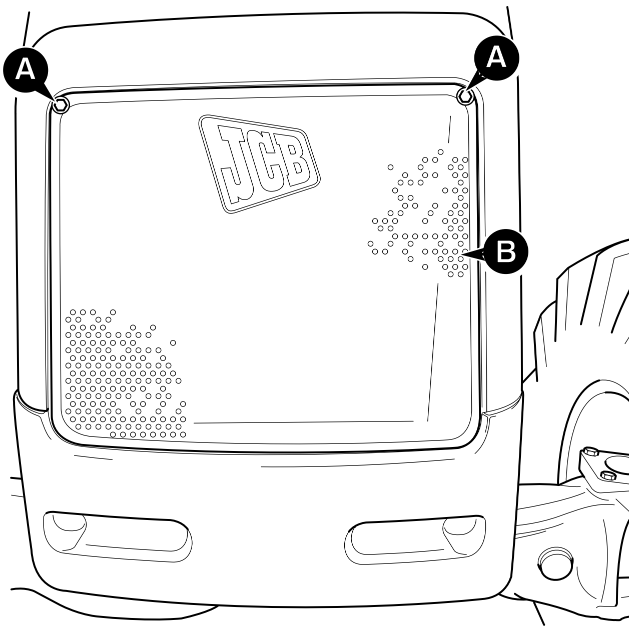
Avoid using neat detergent - always dilute detergents as per the manufacturer's recommendations, otherwise damage to the paint finish may occur.

Always adhere to local regulations regarding the disposal of debris created from machine cleaning.

With machines used in an agricultural application, pay particular attention to the following:

1 Radiator Enclosure
Remove all combustible material from the radiator enclosure. To gain access, loosen and remove retaining bolts **A** and then remove the protection mesh **B**.

2 Engine Compartment
Do not allow debris to accumulate around the engine, pay particular attention to the exhaust area, remove all combustible material.



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Checking the Seat Belt Condition and Security

WARNING

When a seat belt is fitted to your machine replace it with a new one if it is damaged, if the fabric is worn, or if the machine has been in an accident. Fit a new seat belt every three years.

2-3-1-7/1

Inspect the seat belt for signs of fraying and stretching. Check that the stitching is not loose or damaged. Check that the buckle assembly is undamaged and works correctly.

Check that the belt mounting bolts are undamaged, correctly fitted and tightened.

Checking the ROPS/FOPS Structure

⚠ WARNING

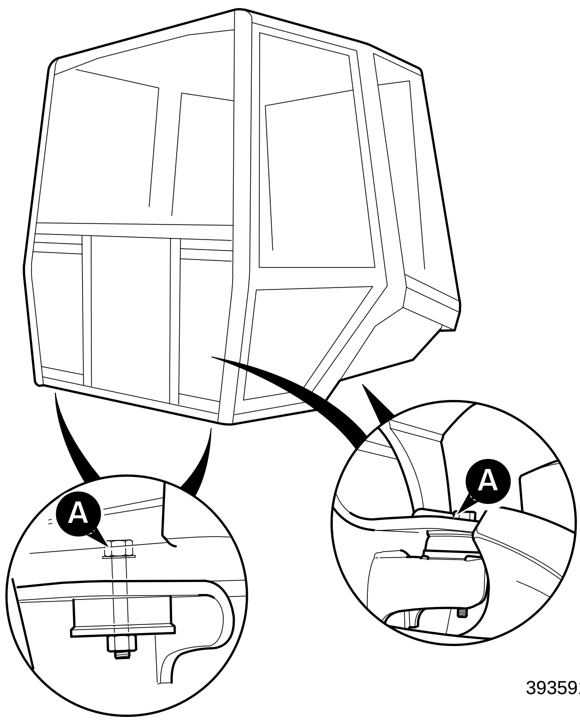
The machine is fitted with a Roll Over Protection Structure (ROPS) and a Falling Objects Protection Structure (FOPS). You could be killed or seriously injured if you operate the machine with a damaged or missing ROPS/FOPS. If the ROPS/FOPS has been in an accident, do not use the machine until the structure has been renewed. Modifications and repairs that are not approved by the manufacturer may be dangerous and will invalidate the ROPS/FOPS certification.

INT-2-1-9/3

For assistance, contact your JCB distributor. Failure to take these precautions could result in death or injury to the operator.

Check the structure for damage. Check that the mounting bolts are installed and undamaged. Check the bolt torques. Tighten them to the correct torque if necessary.

Torque-tighten bolts **A** to 200 Nm (148 lbf ft).



393591

Fire Extinguisher (when fitted)

Checking the Fire Extinguisher

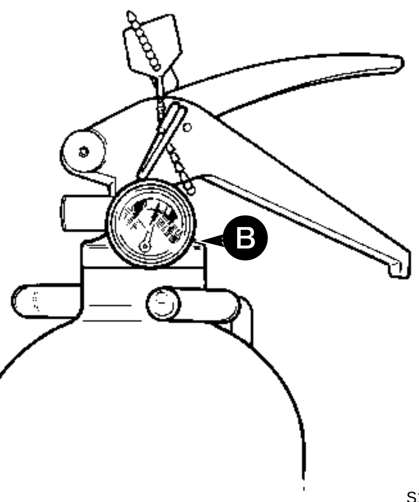
Check the fire extinguisher for damage, security and signs of leaking.

Check that the gauge **B** indicates that the extinguisher is charged ie. the needle is in the GREEN segment.

Note: If the needle is in or very near the RED segment at either end of the gauge, the extinguisher must be serviced or replaced.

Make sure the safety pin is fitted and secure.

The extinguisher should be serviced every 12 months by a suitably qualified person.



S170520

Removing and Fitting a Side Panel

⚠ WARNING

The loader arms must be raised and locked before you remove an engine side panel. Keep the arms locked up until the side panel is put back. If you do not lock the loader arms, the shovel can fall and you could be crushed. See Loader Arm Safety Strut in MAINTENANCE section.

2-3-1-4/1

⚠ WARNING

Do not remove the engine side panel while the engine is running.

2-3-1-5

1 **Raise and Lock the Loader Arms.**
See **Loader Arm Safety Strut**.

2 **Stop the Engine**
Remove the starter key.

3 **Raise the Bonnet.**
See **Opening and Closing the Bonnet**.

4 **Remove the Side Panel**
Lift the side upwards and outwards.

5 **Fit the Side Panel**
Carefully slot the side panel into position, locating the inner catch. Lower and lock the bonnet. See **Opening and Closing the Bonnet**.

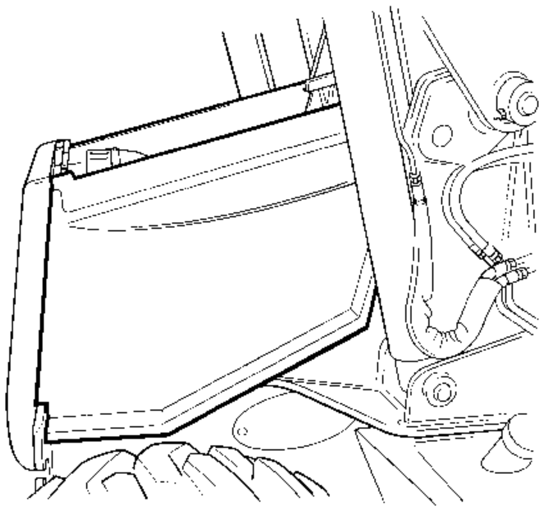
Opening and Closing the Bonnet

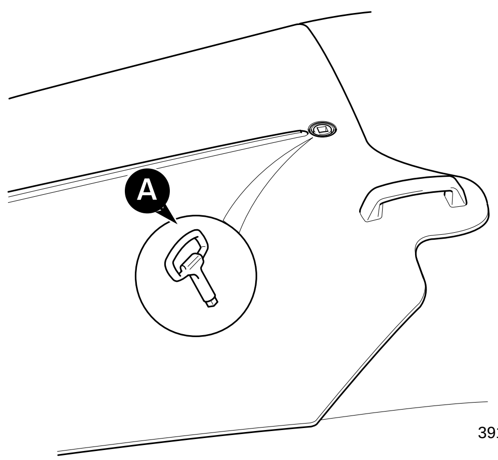
To release the bonnet, insert key **A** into the bonnet lock and turn 90° clockwise.

Open the bonnet until the latch is engaged.

To close the bonnet, release the latch and lower the bonnet.

To lock the bonnet, insert key **A** into the bonnet lock and turn 90° anticlockwise.





You must grease the machine regularly to keep it working efficiently. Regular greasing will also lengthen the machine's working life.

The machine must always be greased after pressure washing or steam cleaning.

Greasing should be done with a grease gun. Normally, two strokes of the gun should be enough. Stop greasing when fresh grease appears at the joint.

See **Fluids, Lubricants, Capacities and Specifications** for the recommended grease.

See **Service Schedules** for the recommended greasing intervals.

In the following illustrations the grease points are numbered. Count them off as you grease them.

Refit the grease point dust caps after greasing.

⚠ WARNING

You will be working close into the machine for these jobs. Lower the attachments if possible. Remove the starter key and disconnect the battery. This will prevent the engine being started. Make sure the parking brake is engaged.

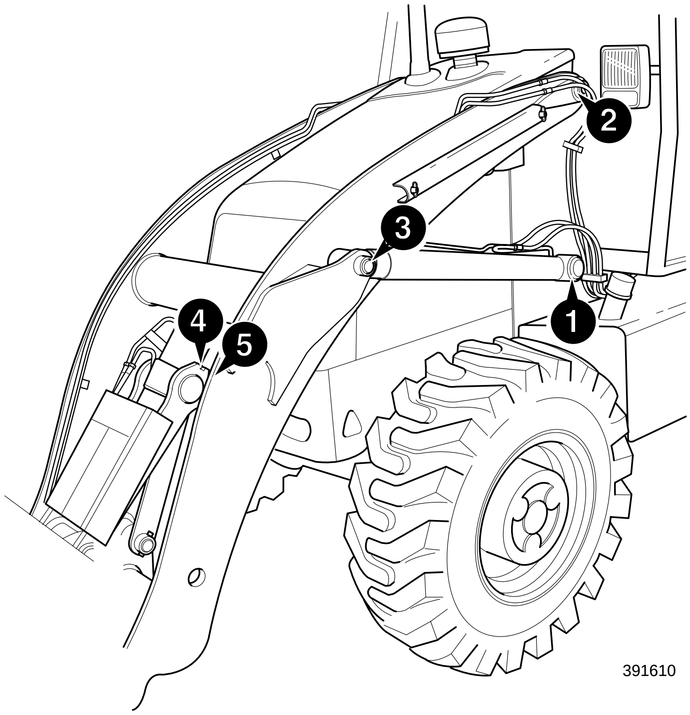
Chock all four wheels before getting under the machine.

2-3-2-1

Loader Arms - Standard

For each grease point shown there is another on the other side of the machine.

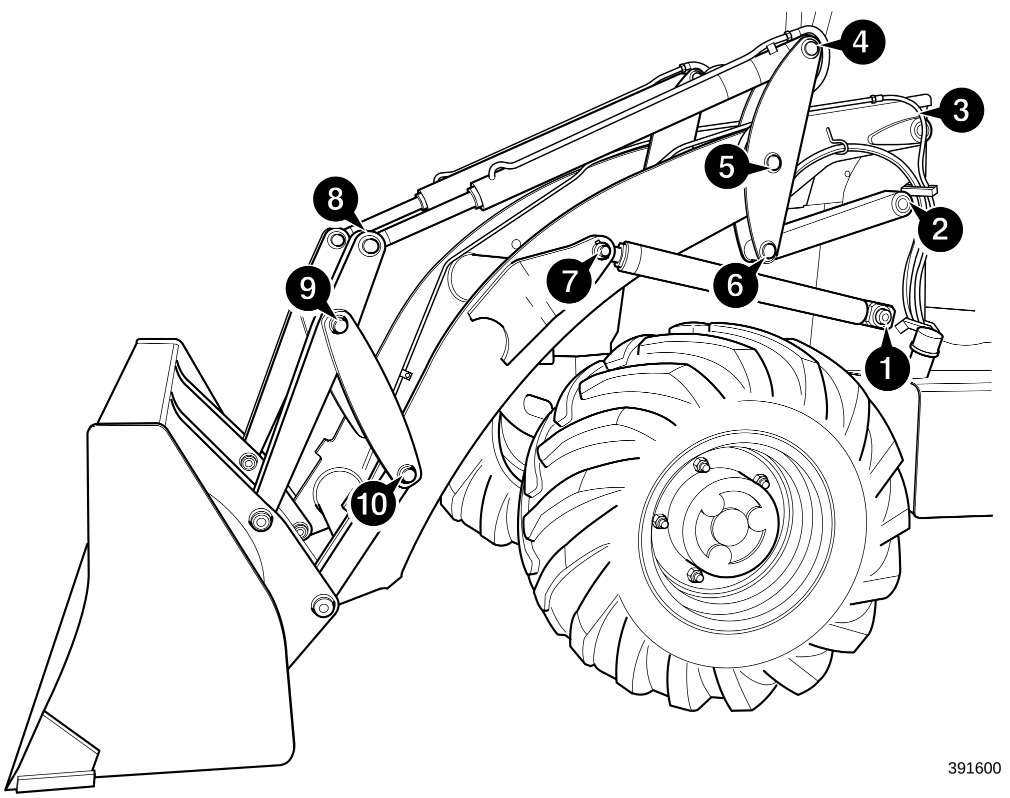
Total 10 grease points



Loader Arms - High Specification

For each grease point shown there is another on the other side of the machine.

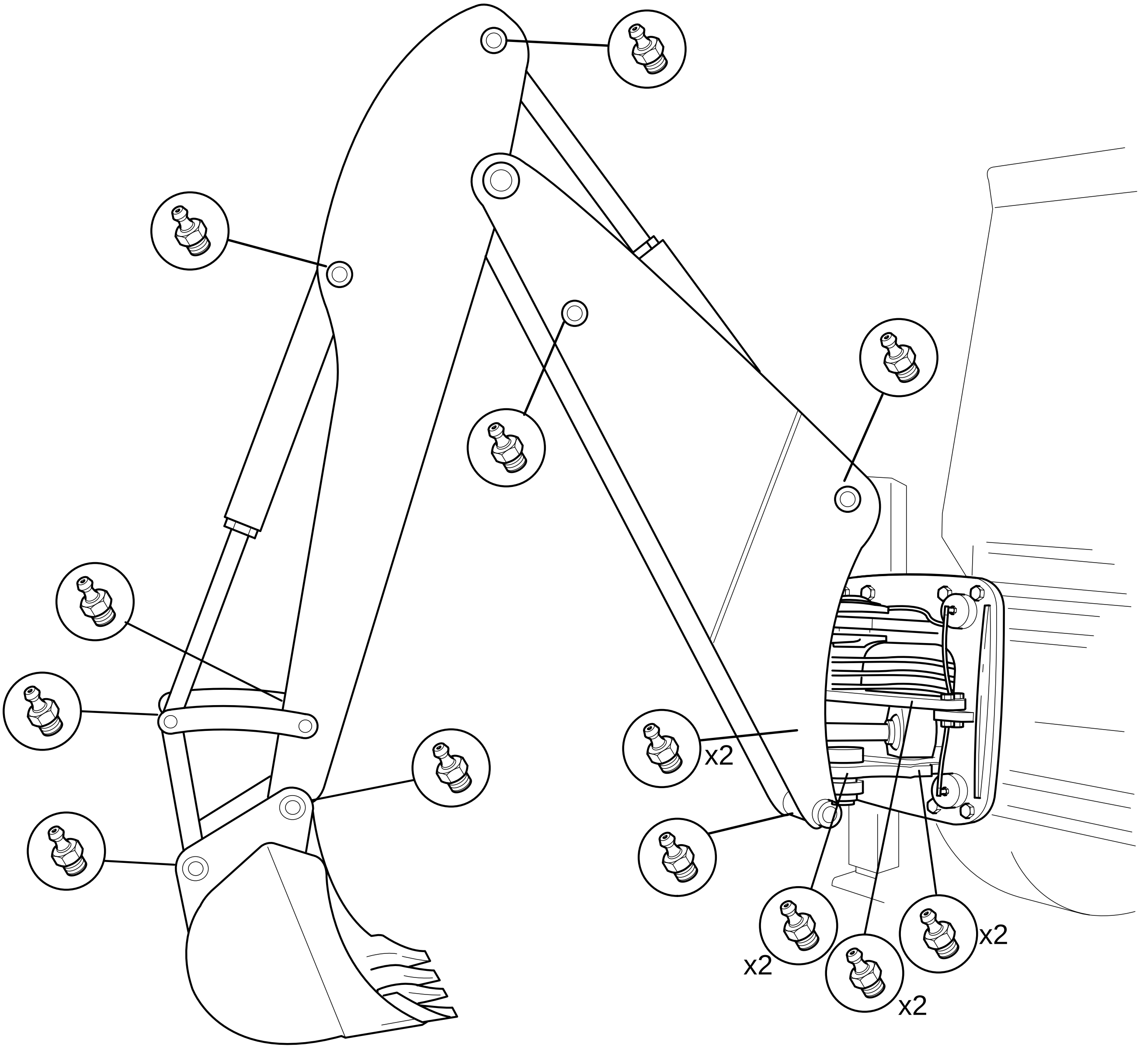
Total 20 grease points



Backhoe

17 Grease Points.

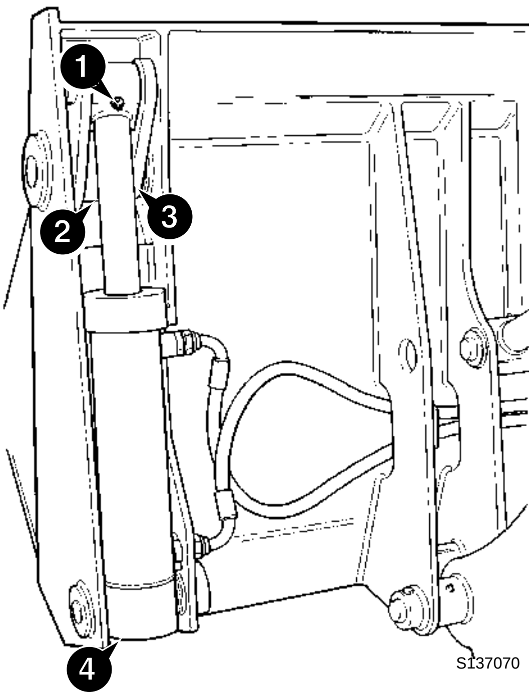
Note: Do not grease the kingpost mounting rails.



6-in-1 Clamshovel (if fitted)

For each grease point shown there is another at the other end of the bucket.

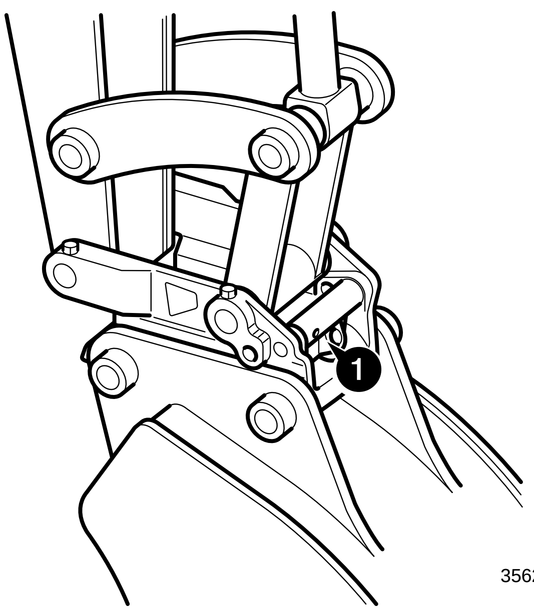
4 grease point each end -
Total 8 Grease Points



S137070

Backhoe Quick-Hitch (Mechanical)

1 Grease Points



356211

Backhoe Quick-Hitch (Hydraulic)

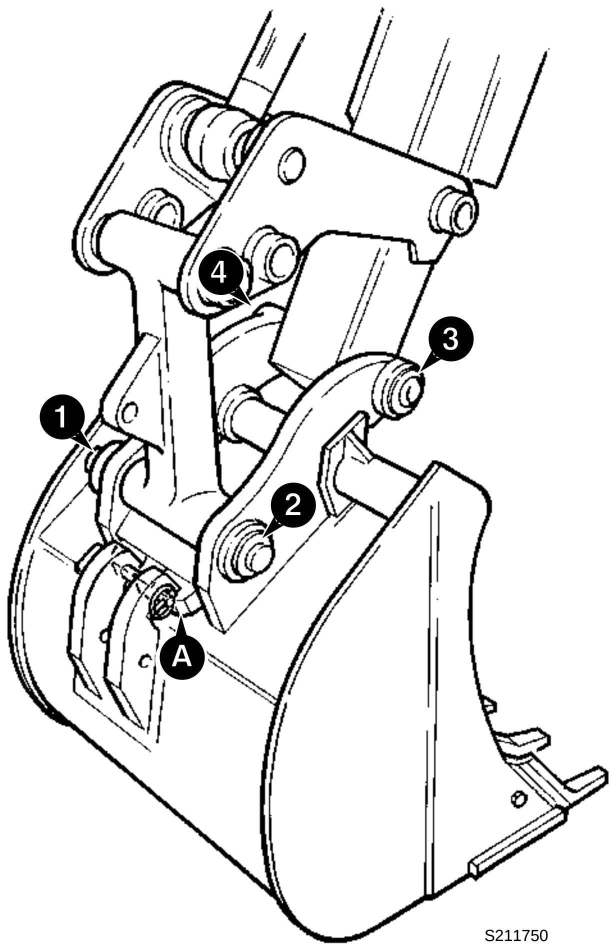
⚠ CAUTION

Waxoyl contains turpentine substitute, which is inflammable. Keep flames away when applying Waxoyl. Waxoyl can take a few weeks to dry completely. Keep flames away during the drying period.

Do not weld near the affected area during the drying period. Take the same precautions as for oil to keep Waxoyl off your skin. Do not breathe the fumes. Apply in a well-ventilated area.
5-3-1-9

Coat the slide **A** with **Waxoyl** .

4 Grease Points



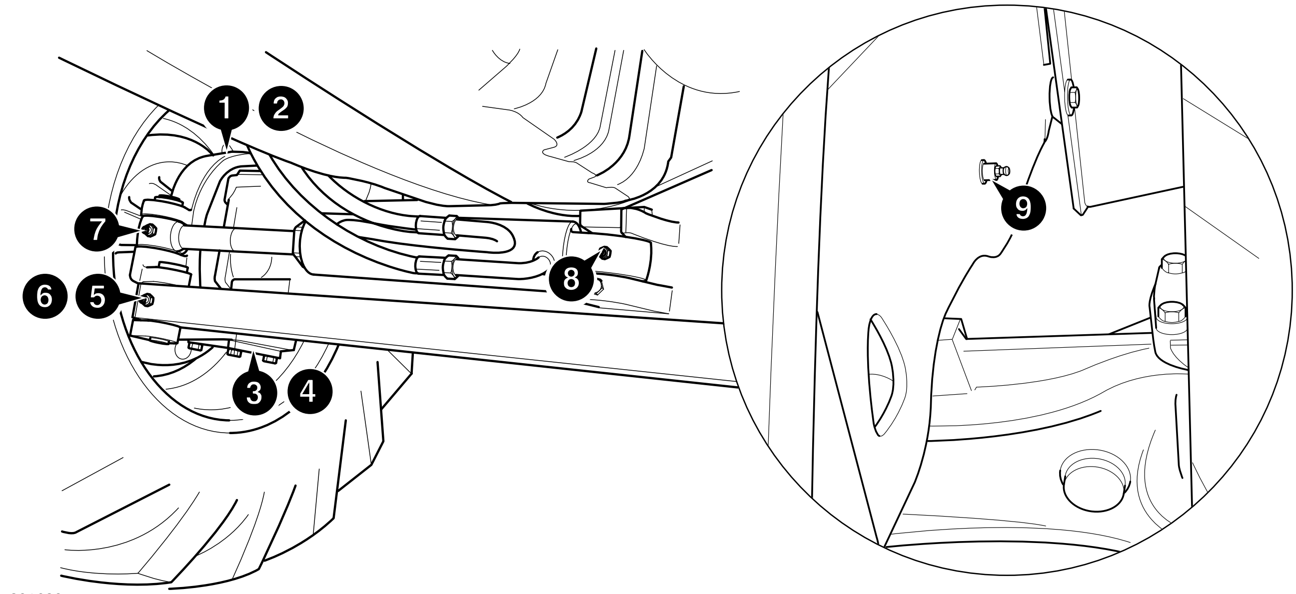
S211750

Axles

Front Axle

Total 9 Grease Points.

Note: When greasing, raise the wheels and swing them from lock to lock. This will ensure full penetration.

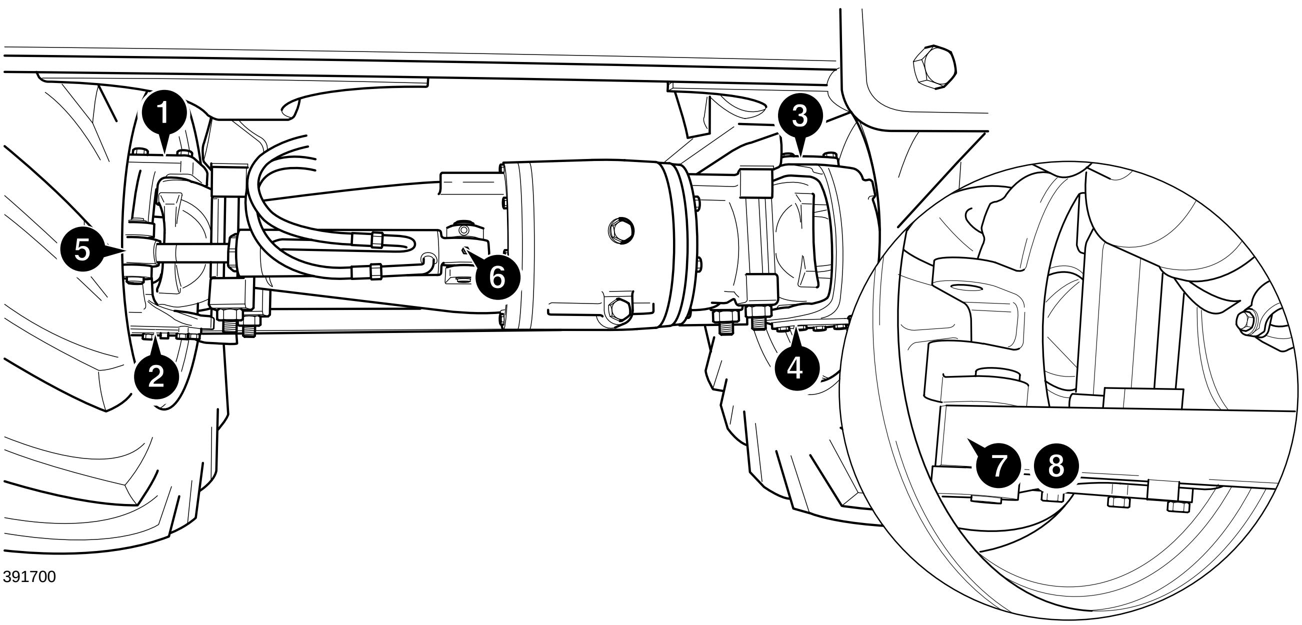


391620

391610

Rear Axle

Total 8 Grease Points.



391700

Propshafts

6 Grease Points.

Read **Greasing (Daily)** for general information about greasing.

⚠ WARNING

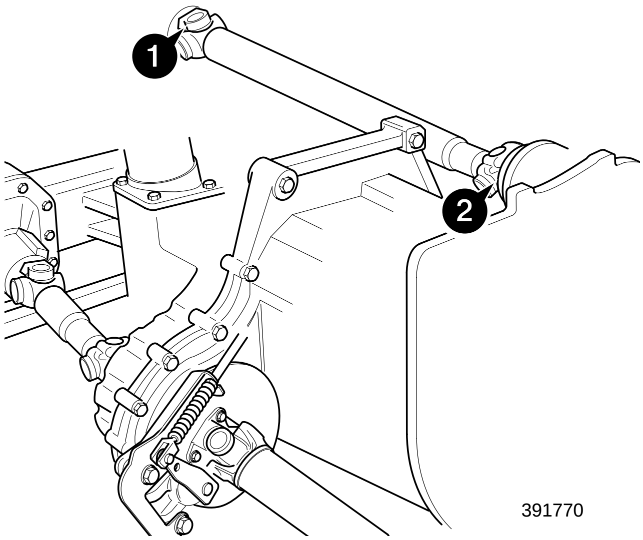
You will be working close into the machine for these jobs. Lower the attachments if possible. Remove the starter key and disconnect the battery. This will prevent the engine being started. Make sure the parking brake is engaged.

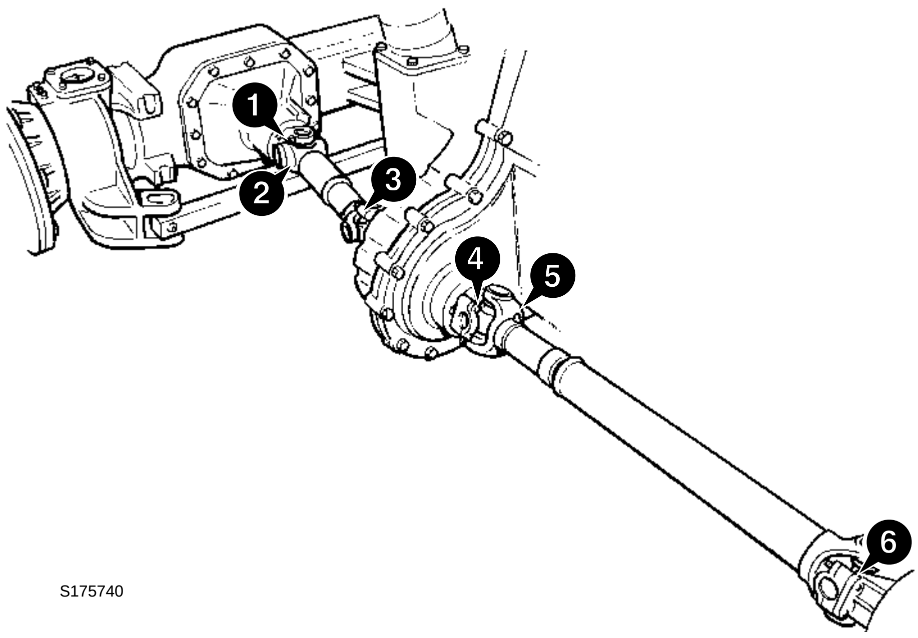
Chock all four wheels before getting under the machine.
2-3-2-1

Airmaster Driveshaft

2 Grease Points.

Read **Greasing (Daily)** for general information about greasing.





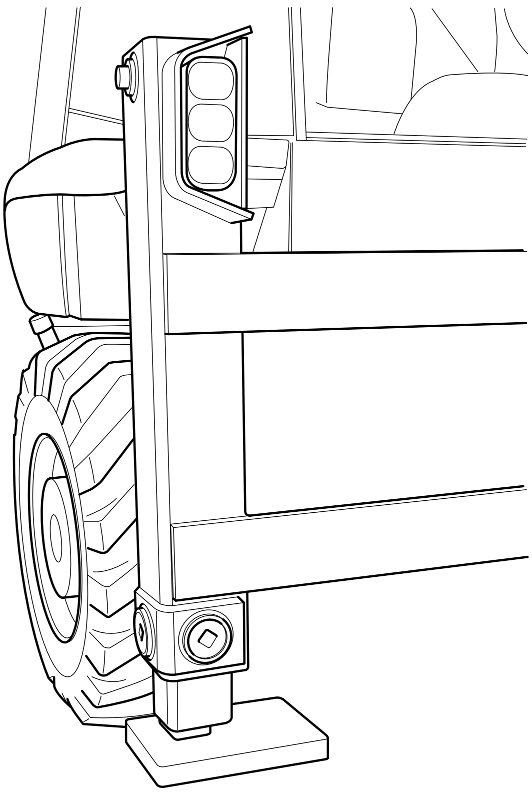
Stabiliser Legs

CAUTION

Waxoyl contains turpentine substitute, which is inflammable. Keep flames away when applying Waxoyl. Waxoyl can take a few weeks to dry completely. Keep flames away during the drying period.

Do not weld near the affected area during the drying period. Take the same precautions as for oil to keep Waxoyl off your skin. Do not breathe the fumes. Apply in a well-ventilated area.
5-3-1-9

Coat the stabiliser legs with **Waxoyl**.


391680

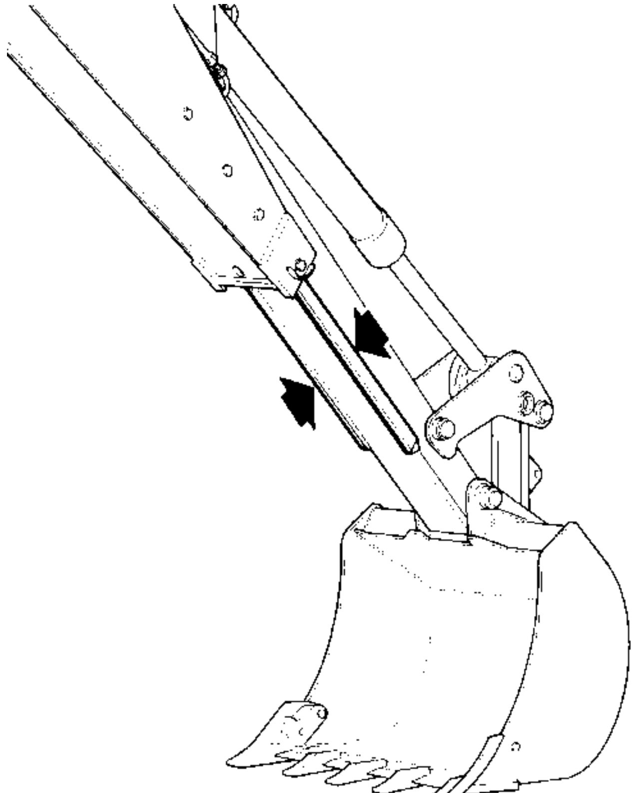
Extending Dipper

CAUTION

Waxoyl contains turpentine substitute, which is inflammable. Keep flames away when applying Waxoyl. Waxoyl can take a few weeks to dry completely. Keep flames away during the drying period.

Do not weld near the affected area during the drying period. Take the same precautions as for oil to keep Waxoyl off your skin. Do not breathe the fumes. Apply in a well-ventilated area.
5-3-1-9

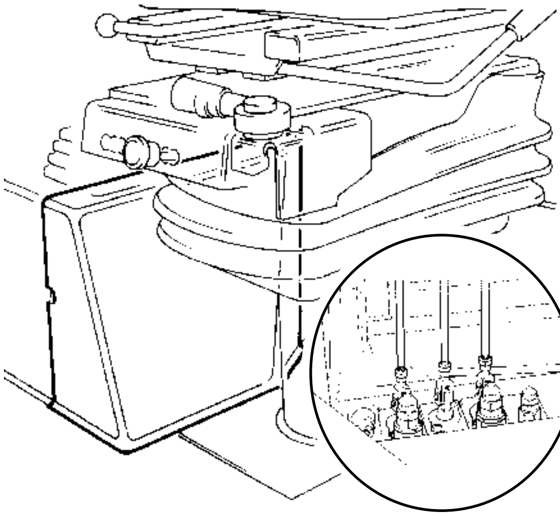
Extend the dipper. Coat the runners with **Waxoyl** as shown.


S140080

The following points should be **lightly** oiled with engine oil.

WARNING

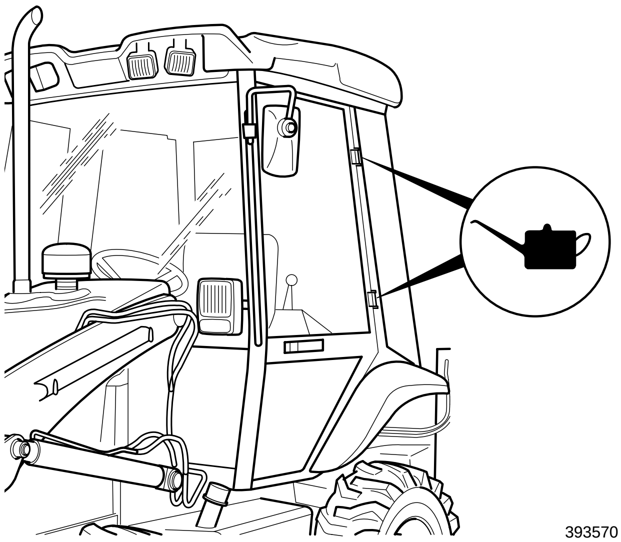
Make the machine safe before getting beneath it. Lower the attachments to the ground; engage the parking brake; remove the starter key, disconnect the battery.
2-3-2-2


S175760 & S175750

1 Control Levers
Oil the clevis at the bottom of every attachment control lever (loader control levers shown).

Remove the bolts securing the side console moulding **A** to gain access to the loader control levers.

2 Hinges
Oil all hinges (door hinges shown).


393570

⚠ WARNING

An exploding tyre can kill, inflated tyres can explode if overheated. Do not cut or weld the rims. Use a tyre/wheel specialist for all repair work.
2-3-2-7

Tyre Inflation

These instructions are for adding air to a tyre which is already inflated. If the tyre has lost all its air pressure, call in a qualified tyre mechanic. The tyre mechanic should use a tyre inflation cage and the correct equipment to do the job.

1 Prepare the Wheel

Before you add air to the tyre, make sure it is correctly fitted on the machine or installed in a tyre inflation cage.

2 Prepare the Equipment

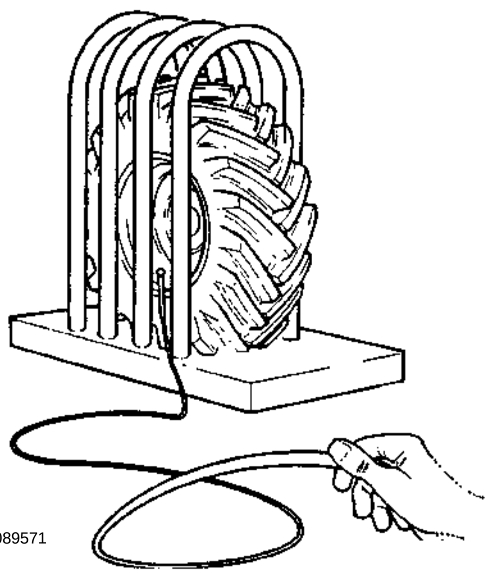
Use only an air supply system which includes a pressure regulator. Set the regulator no higher than 1.38 bar (20 lbf/in^2) above the recommended tyre pressure. Refer to Section F **Technical Data - Wheels and Tyres** for recommended tyres and pressures for your machine.

Use an air hose fitted with a self-locking air chuck and remote shut-off valve.

3 Add the Air

Make sure that the air hose is correctly connected to the tyre valve. Clear other people from the area. Stand behind the tread of the tyre while adding the air.

Inflate the tyre to the recommended pressure. *Do not over-inflate.*


S089571

Checking the Roadwheel Tightness

On new machines, and whenever a wheel has been removed, check the wheel nut torques every two hours until they stay correct.

Every day, before starting work, check that the wheel nuts are tight.

The correct torques are shown in the table below.

Front		**Rear**	
Nm	lbf ft	Nm	lbf ft
680	500	680	500

⚠ WARNING

If, for whatever reason, a wheel stud is renewed, all the studs for that wheel must be changed as a set, since the remaining studs may have been damaged.
2-3-2-8

Cleaning the Pre-Cleaner

Note: Do not run the engine with the filter pre-cleaner or the rain cap removed. If the pre-cleaner is more than a third full of dust, empty it.

1 Remove the Cover

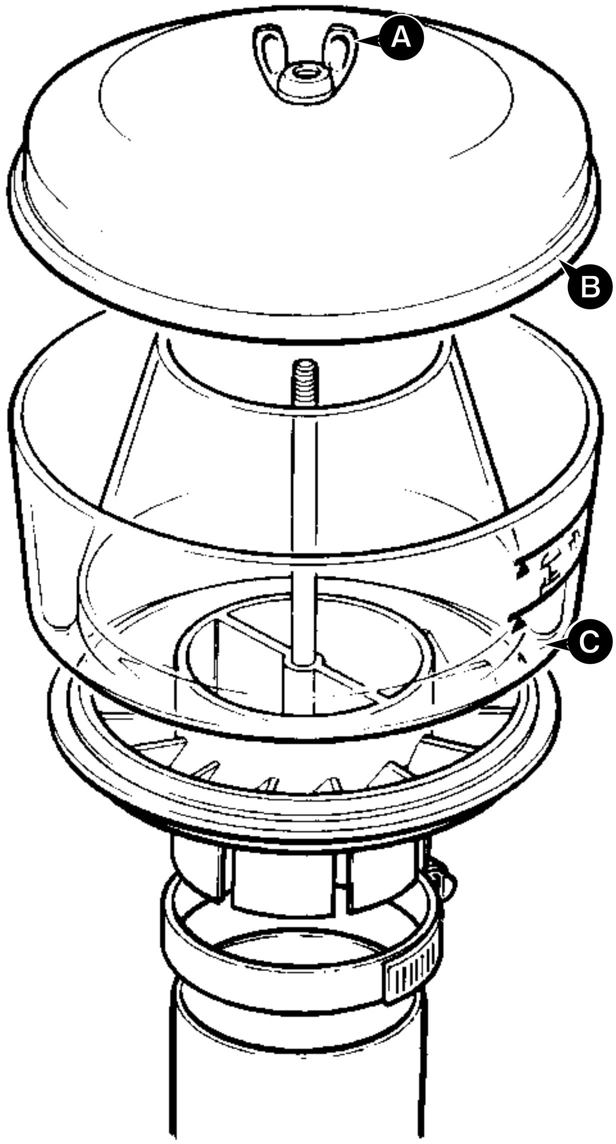
Unscrew the wingnut **A** and lift off the cover **B**.

2 Empty and Clean the Bowl

Carefully remove the dust bowl **C** and empty out the dust. Make sure the dust does not fall into the air filter intake. Wipe the bowl clean. Remove oil or grease by washing in hot water with a little detergent. Dry the bowl before refitting it.

3 Fit the Bowl

Carefully set the bowl in position on the air filter. Fit and tighten the wingnut.



S111320

Changing the Elements

⚠ CAUTION

The outer element must be renewed immediately if the warning light on the instrument panel illuminates.
2-3-3-1

Note: Do not attempt to wash or clean the elements - they must only be renewed.

Note: Do not run the engine with the dust valve **J** removed.

Note: A new inner element must be fitted at least every third time the outer element is changed. As a reminder, mark the inner element with a felt tipped pen each time the outer element is changed.

1 Stop the engine.

2 Remove the engine side panel (left hand side).

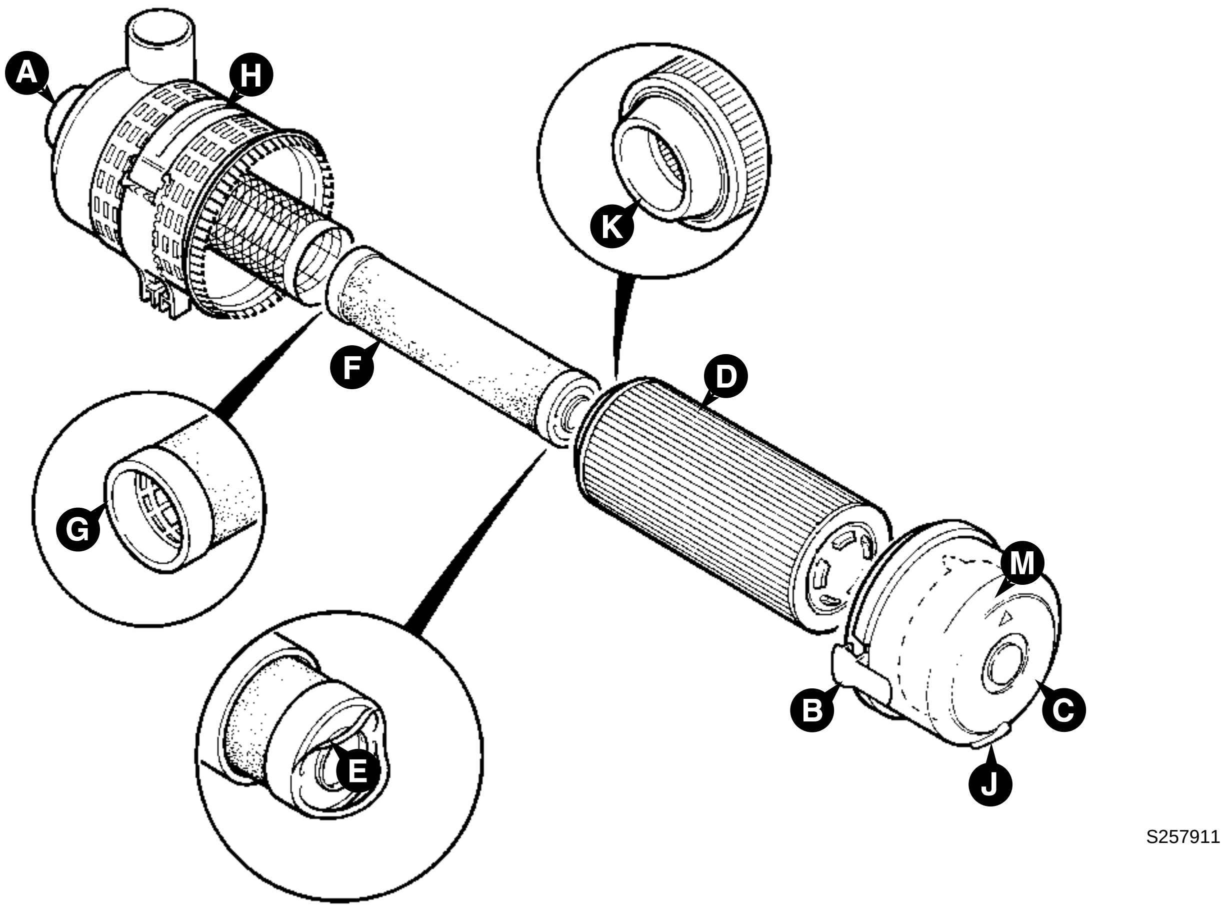
3 If changing the inner element, cover the end of the hose to prevent rain and dirt from getting into the engine.

4 Depress clips **B** and lift off cover **C**. Remove outer element **D**. Take care not to tap or knock the element. If the inner element is to be changed, lift up pulls **E** and remove inner element **F**.

5 Clean inside the canister **H**, cover **C** and dust valve **J**.

6 Insert the new elements into the canister, pushing them firmly in so that seals **G** and **K** are fully seated. Fit cover **C** with dust valve **J** at the bottom. Push the cover firmly into position and make sure it is secured by clips **B**.

7 Refit the induction hose to stub pipe **A**. Make sure that the wire is connected to the **Air Filter Blocked** switch.



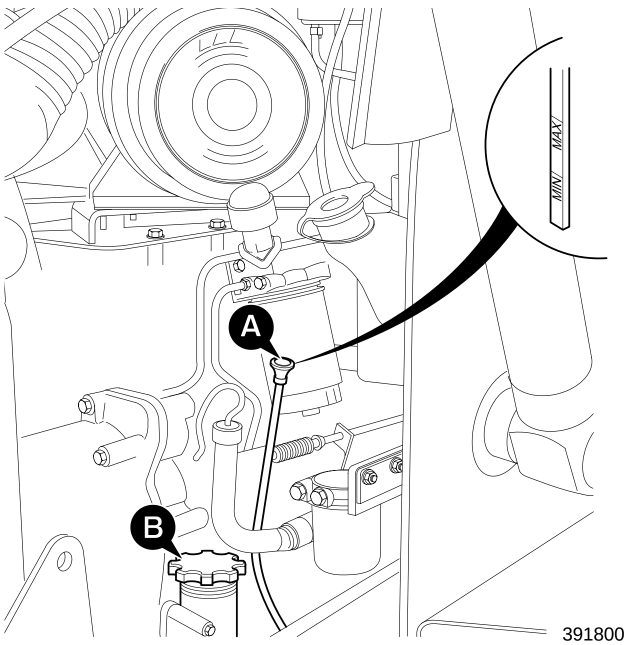
Checking the Oil Level

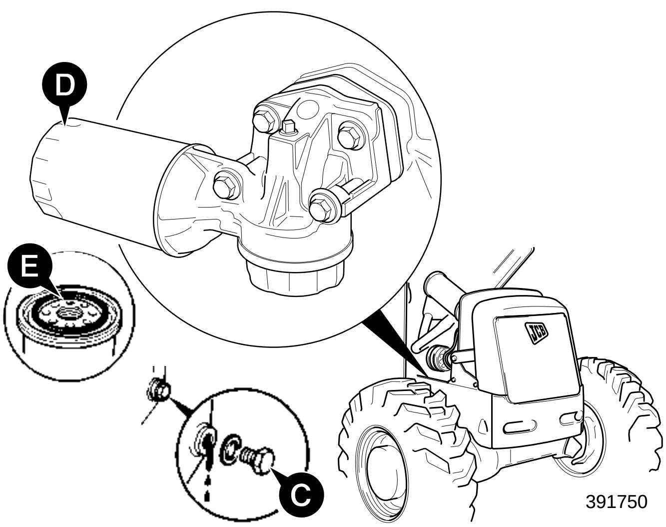
1 **Prepare the Machine**
Park the machine on level ground. Lower the backhoe to the ground.

2 **Stop the Engine**
Remove the starter key

3 **Raise the Bonnet**
See **Opening and Closing the Bonnet**.

4 **Check the Oil Level**
Check that the oil level is between the two marks on the dipstick **A**. Add oil if necessary, through filler **B.** Use only the recommended oil, see **Fluids, Lubricants, Capacities and Specifications**. Make sure that the dipstick and filler cap are fully inserted and tightened.





Changing the Oil and Filter

⚠ WARNING

Hot oil and engine components can burn you. Make sure the engine is cool before doing this job.
2-3-3-2

⚠ WARNING

Oil is toxic. If you swallow any oil, do not induce vomiting, seek medical advice. Used engine oil contains harmful contaminants which can cause skin cancer. Do not handle used engine oil more than necessary. Always use barrier cream or wear gloves to prevent skin contact. Wash skin contaminated with oil thoroughly in warm soapy water. Do not use petrol, diesel fuel or paraffin to clean your skin.
INT-3-2-3

1 **Do Steps 1 to 3 of 'Checking the Oil Level'**

2 **Remove the Right Hand Side Panel**
See **Engine Panels**.

3 **Drain the Oil**
- **a** Place a container that can hold at least 12 litres (3 gal) beneath the engine *(To catch the oil)*.
- **b** Remove drain plug **C** and its 'O' ring. Let the oil drain out, then clean and refit the drain plug with a new 'O' ring. Tighten to 34 Nm (25 lbf ft).

4 **Change the Filter**
- **a** Unscrew the filter canister **D**; remember that it will be full of oil.
- **b** Check that the filter head adapter is secure.
- **c** Clean the filter head.
- **d** Add clean engine lubricating oil to the new filter canister. Allow enough time for the oil to pass through the filter element.
- **e** Smear the seal **E** on the new filter with oil. Screw in the new filter canister - hand tight only.

5 **Fill the System**
Fill the engine to the **max** mark on the dipstick with new oil through the filler. See **Fluids, Lubricants, Capacities and Specifications** for recommended oil grades. Wipe off any spilt oil. Check for leaks. Make sure the filler cap is correctly refitted.

6 **Obtain Oil Pressure**
Make sure the engine will not start and turn the starter switch to operate the starter motor until the oil pressure light is extinguished. *(To make sure the engine will not start, remove the engine shut-off solenoid fuse housed in the fuse box).*

7 **Check for Leaks**
Start the engine and check for leaks. When the engine has cooled, check the oil level.

Adjusting the Fan Belt

1 Raise and Lock the Loader Arms

2 Remove the Right Hand Side Panel

⚠ WARNING

Make sure the engine cannot be started. Disconnect the battery before doing this job.

2-3-3-5

3 Loosen the Alternator

Loosen pivot fastening bolts **A** and **B**. Loosen adjustment link fastening bolts **C** and **D**.

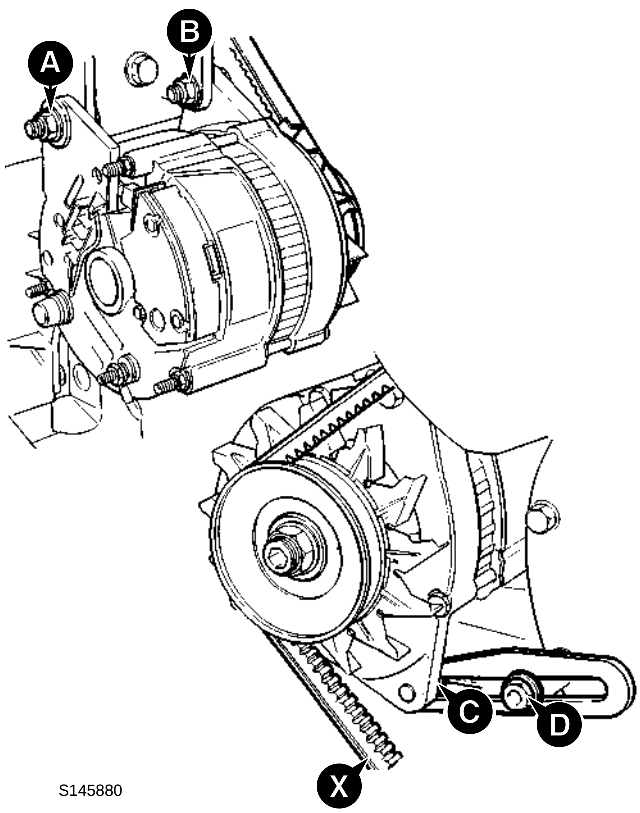
4 Adjust the Fan Belt

Position the alternator so that there is 10 mm (3/8 in) slack at point **X**.

5 Secure the Alternator

Tighten bolts **C, D, B** and then **A**. Make sure that bolt **A** is the last bolt to be tightened.

Note: If a new belt is fitted, the belt tension must be checked again after the first 20 hours of operation.



S145880

Checking the Coolant Level

⚠ WARNING

The cooling system is pressurised when the coolant is hot. Hot coolant will burn you. Make sure the engine is cool before checking the coolant level or draining the system.

2-3-3-3

1 Park the Machine on Level Ground

Engage the parking brake. Stop the engine and let it cool down.

2 Raise the Bonnet

See **Opening and Closing the Bonnet**.

3 Check the Level

The coolant level should be between the COLD/MIN and the HOT/MAX marks on the coolant reservoir **F**.

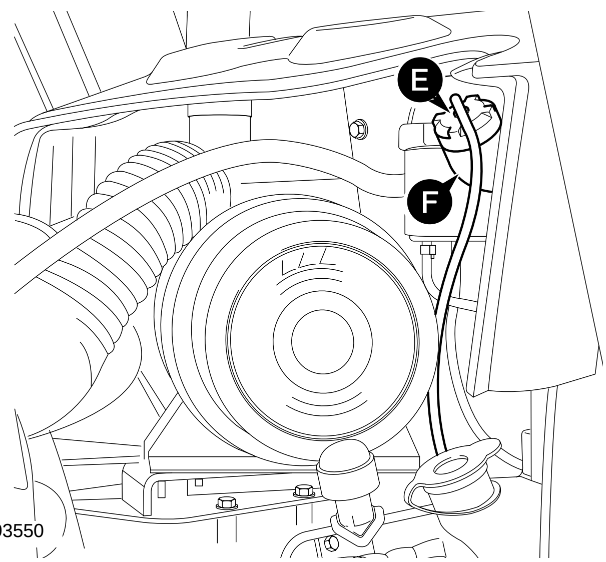
4 Top-up the Reservoir

If necessary, remove reservoir filler cap **E** and top-up to the required level. See **Fluids, Lubricants, Capacities and Specifications**. Refit reservoir cap.

5 Check for Leaks

Run the engine to raise the coolant to working temperature and pressure. Stop the engine and check for leaks.

Note: Check the quality of the antifreeze mixture every year - before the cold weather starts. Change it every two years.



393550

Changing the Coolant

WARNING

The cooling system is pressurised when the coolant is hot. Hot coolant will burn you. Make sure the engine is cool before checking the coolant level or draining the system.
2-3-3-3

1 **Park the Machine on Level Ground**
Engage the parking brake. Stop the engine and let it cool down.

2 **Open the Bonnet**
See **Opening and Closing the Bonnet**.

3 **Remove the Left Hand Side Panel.**
See **Engine Panels.**

4 **Remove the Filler Cap**
Carefully loosen cap **E**. Let any pressure escape. Remove the cap.

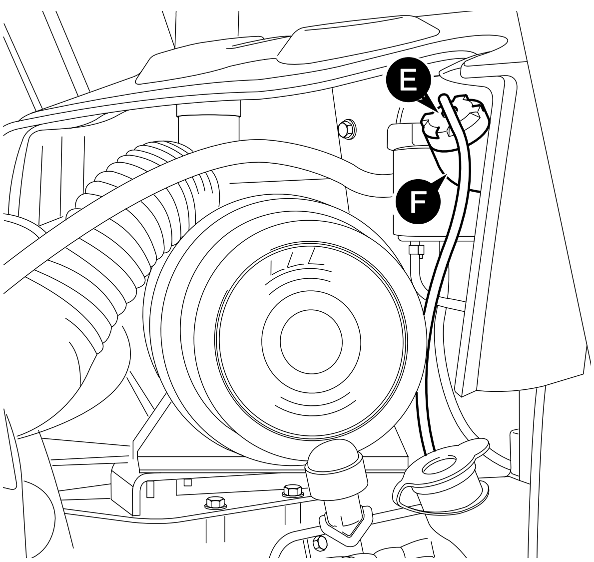
CAUTION

Keep your face away from the drain hole when removing the drain plug.
2-3-3-4

5 **Drain the Cylinder Block**
Remove the drain plug **G** and let the coolant drain out. Make sure the drain hole is not blocked.

6 **Drain the Radiator**
Remove hose **H** and drain the coolant.

7 **Flush the System with Clean Water**
Refit the drain plug **G** and radiator hose **H**.



8 **Fill the System with the Correct Coolant Mixture.**
See **Coolant Mixtures.**

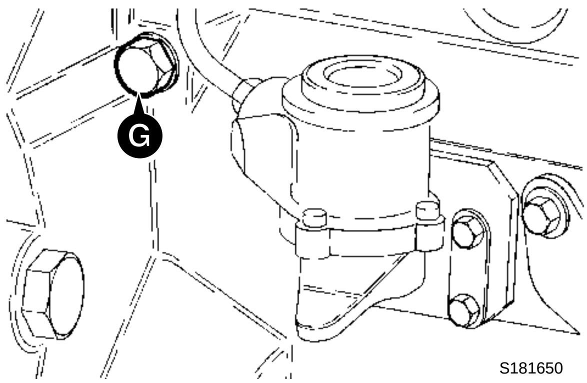
Use the necessary mix of clean, soft water and anti-freeze. See **Coolant Mixtures**. Fill the reservoir to the COLD/MIN level on coolant reservoir **F**.

9 **Run the Engine**
Start the engine and run at idle to circulate the coolant, top up with coolant as necessary. Refit filler cap **E**.

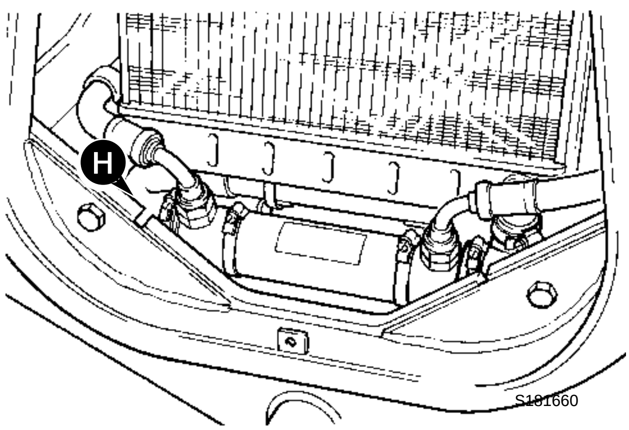
10 **Check for Leaks**
- **a** Run the engine and raise the coolant to working temperature and pressure.
- **b** Stop the engine.
- **c** Look and listen for leaks.
- **d** Refit engine panel and bonnet.

Note: Make sure the heater shut-off tap is in the open position before running the engine. This will ensure the coolant mixture circulates through the entire cooling system.

Note: Check the quality of the anti-freeze mixture every year. Change the anti-freeze every two years.



S181650



S181660

Types of Fuel

Use good quality diesel fuel to get the correct power and performance from your engine. The recommended fuel specification for engines is given below.

Cetane Number: 45(minimum)
Viscosity: 2.5/4.5 centistokes at 40 °C (104 °F)
Density: 0.835/0.855 kg/litre (0.872/0.904 lb/pint)
Sulphur:0.5% of mass (maximum)
Distillation: 85% at 350 °C (662 °F)

Cetane Number
Indicates ignition performance. Fuel with a low cetane number can cause cold start problems and affect combustion.

Viscosity
Is the resistance to flow. If this is outside limits, the engine performance can be affected.

Density
Lower density will reduce engine power. Higher density will increase both engine power and exhaust smoke.

Sulphur
High sulphur content can cause engine wear. (High sulphur fuel is not normally found in North America, Europe or Australia.) If you have to use high sulphur fuel you must also use a highly alkaline engine lubricating oil; or change the normal oil more frequently.

Distillation
This indicates the mixture of different hydrocarbons in the fuel. A high ratio of lightweight hydrocarbons can affect the combustion characteristics.

Fuel Standards

Consult your fuel supplier, JCB distributor about the suitability of any fuel you are unsure of.

Low Temperature Fuels

Special winter fuels may be available for engine operation at temperatures below 0 °C (32 °F). These fuels have a lower viscosity. They also limit wax formation in the fuel at low temperatures. *(Wax forming in the fuel can stop the fuel flowing through the filter.)*

Flow improvers may also be available. These can be added to the fuel to reduce wax formation.

Fatty Acid Methyl Ester Fuels as a Replacement for Diesel Fuels

Fuel resources such as Rape Methyl Ester and Soybean Methyl Ester, collectively known as Fatty Acid Methyl Esters are being used as alternatives and extenders for mineral oil.

Fatty Acid Methyl Esters must conform to certain standards to be of acceptable quality, just as mineral oils do at present.

Consult your JCB distributor for advice about the use of Fatty Acid Methyl Ester fuels, as improper application may impair engine performance.

Petrol

⚠ WARNING

Do not use petrol in this machine. Do not mix petrol with the diesel fuel; in storage tanks the petrol could rise to the top and form flammable vapours.
INT-3-1-6

Advice

If you have to use non-standard fuels, contact your JCB distributor for advice on engine adjustments and oil change periods.

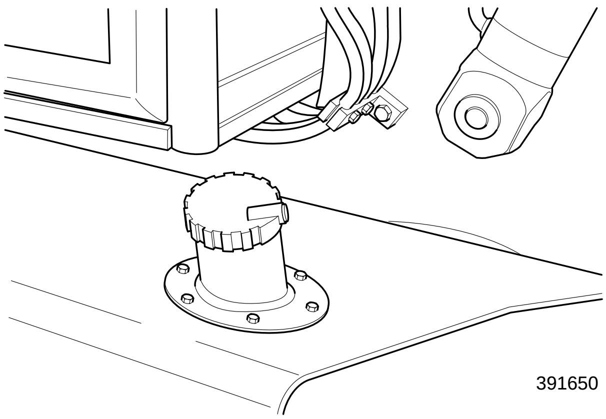
⚠ WARNING

Diesel fuel is flammable; keep naked flames away from the machine. Do not smoke while re-fuelling the machine or working on the engine. Do not refuel with the engine running. There could be a fire and injury if you do not follow these precautions.
INT-3-2-2

Filling the Tank

At the end of every working day, fill the tank with the correct type of fuel. This will prevent overnight condensation from developing in the fuel.

We recommend that you lock the fuel cap to prevent theft and tampering.

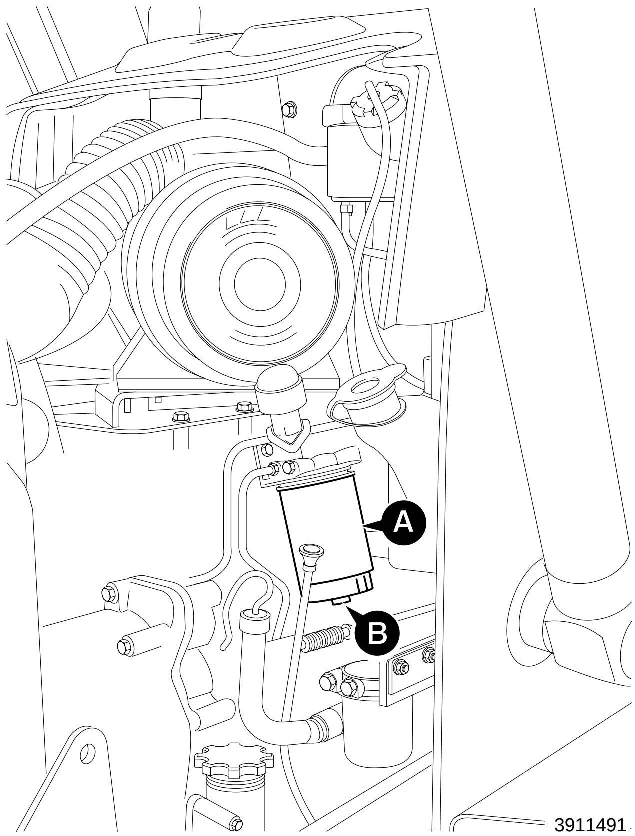


391650

Draining the Filter

1 Park the machine on firm level ground, engage the parking brake and set the transmission to neutral. Raise and block the loader arms. Lower the backhoe to the ground and stop the engine.

2 Drain off any water in the element **A** by turning tap **B**



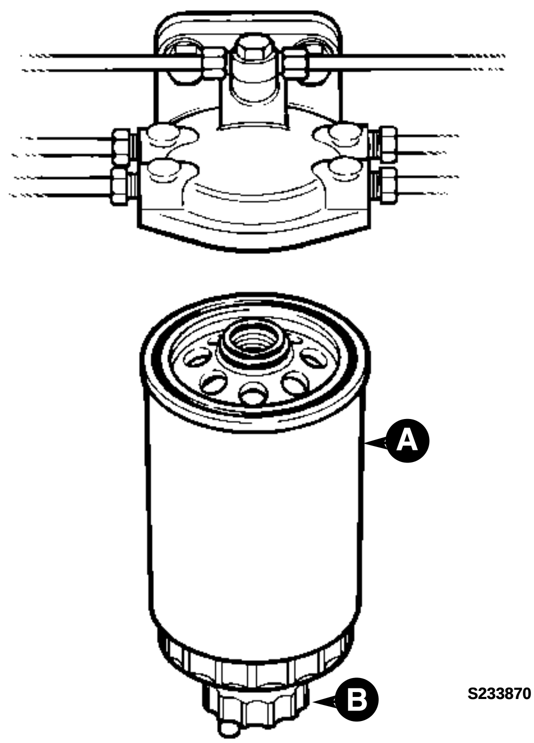
Changing the Filter Element

1 Park the machine on firm level ground, engage the parking brake and set the transmission to neutral. Raise and block the loader arms. Lower the backhoe to the ground and stop the engine.

2 Unscrew the filter element **A**. The element is hand tight but may require a strap wrench to remove. The filter will be full of fuel.

3 To assist with bleeding, fill the new filter element with fuel before fitting. Install new element **A** hand tight only. Check for leaks.

4 Bleed the System.



Draining the Sediment Bowl

1 Park the machine on firm level ground, engage the parking brake and set the transmission to neutral. Raise and block the loader arms. Lower the backhoe to the ground and stop the engine.

2 Look in bowl **A**. If it contains sediment, do Steps 3 to 6. If there is water but no sediment, drain off the water by opening tap **B**. Make sure tap **B** is turned off and secure.

3 Support bowl **A**; unscrew nut **C**. Remove the bowl.

4 Wash the bowl. Use clean fuel.

5 Refit the bowl, make sure gasket is seated correctly.

6 Bleed the System.

Bleed the System

CAUTION

Running the engine with air in the system could damage the fuel injection pump. After maintenance, remove air from the system as detailed below.

2-3-3-7

1 Park the machine on firm level ground, engage the parking brake and set the transmission to neutral. Raise and block the loader arms. Lower the backhoe to the ground and stop the engine.

2 Set the starter key to the IGN position.

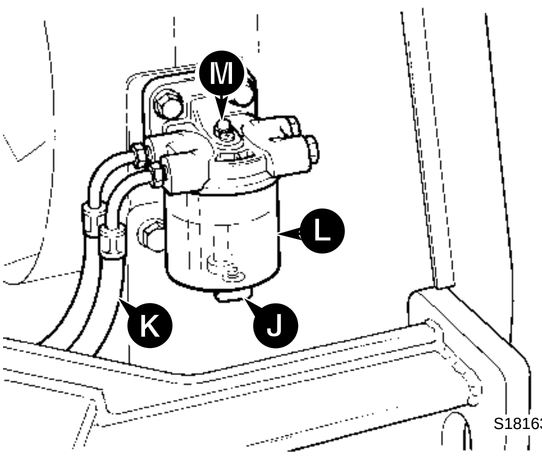
WARNING

Hot oil and engine components can burn you. Make sure the engine is cool before doing this job.

2-3-3-2

3 Operate the fuel lift pump priming lever **X** slowly, for approximately two minutes. The engine is now ready to start. If the engine runs smoothly for a short time, and then begins to run roughly or stops, check again for air in the fuel system. Check all seals and connections, especially in the low pressure side of the system.

Note: If no fuel is moved when the fuel lift pump priming lever **X** is operated, then the pump diaphragm may have rested in a 'maximum lift' position. To move the diaphragm, use the starter key to turn the engine, then try the priming lever again.



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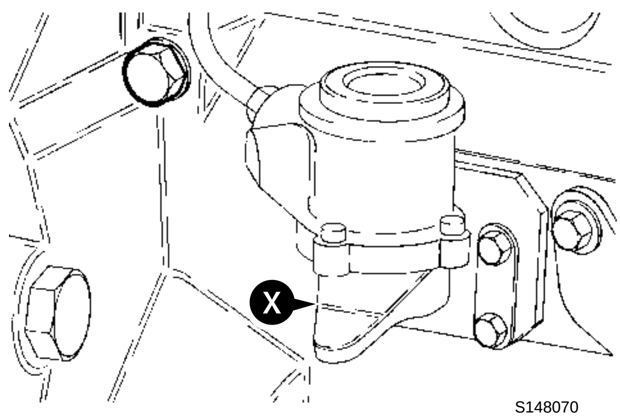


S148070

Checking the Oil Level

⚠ WARNING

Raised loader arms can drop suddenly and cause serious injury. Before working under raised loader arms, fit the loader arm safety strut.

2-1-1-6

1 With the engine stopped, fill the transmission to maximum mark on dipstick/filler **A**. Use only the recommended oil.

2 Start and run the engine slowly for a period not exceeding five minutes. This allows the oil to fill filter, pump, torque converter, oil cooler and hoses.

3 Stop the engine, wait approximately one minute. Recheck the oil level and if required, fill to dipstick level.

Changing the Oil and Filter

⚠ CAUTION

When the strainer is removed, oil will gush out. Keep to one side when you remove the strainer.

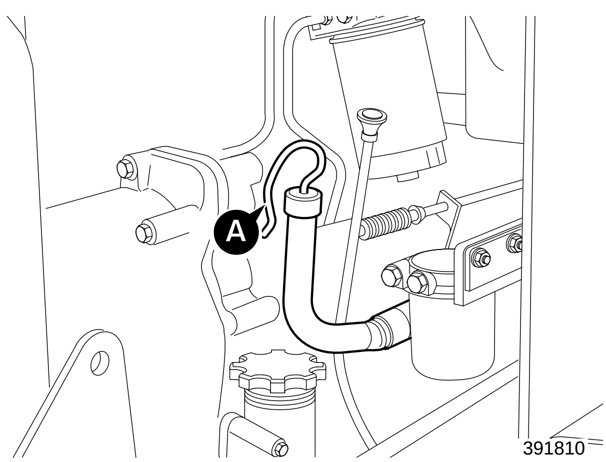
2-3-4-1

1 Park the machine on level ground. Engage the parking brake. Lower the attachments to the ground. Stop the engine. Remove the starter key. Disconnect the battery.

2 Place a container that can hold at least 20.8 litres (4.6 gal) beneath the machine. (To catch the oil). Remove bolts **D**. Pull out the strainer **E** and its gasket **F**.

3 Clean the strainer with a suitable solvent. Follow the solvent manufacturer's instructions on safety.

4 Fit the strainer and a new gasket **F**. Apply JCB Threadlocker and Sealer to bolts **D** before fitting and tightening them. Torque tighten the bolts to 10 Nm (7 lbf ft).



391810

5 Unscrew and remove the filter **B**. Fit the new filter:

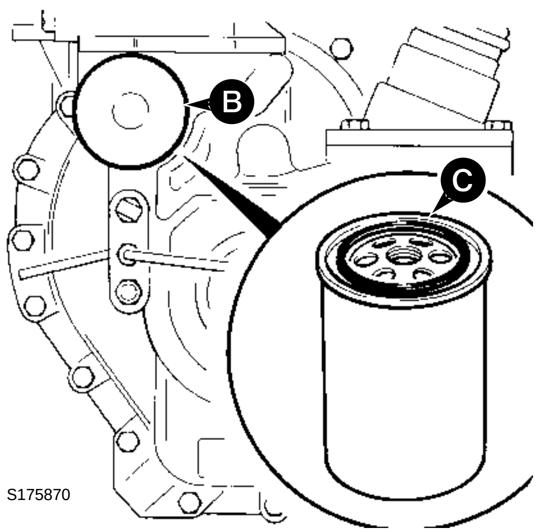
5.1 Smear seal **C** with transmission oil.

5.2 Screw the filter on until it just contacts the filter head.

5.3 Turn the filter at least another 3/4 of a turn.

6 Fill the system with new oil through the dipstick/filler **A**. Do not fill past the top mark on the dipstick.

Note: Fit only a genuine supplied JCB filter, otherwise damage to the system may be incurred through contamination.



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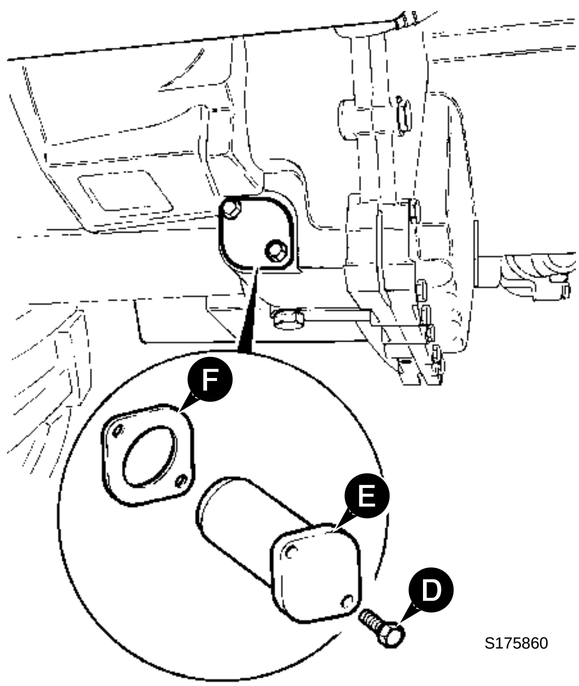


S175860

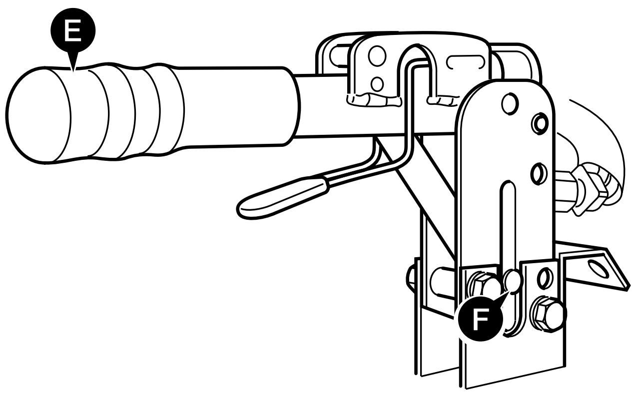
Parking Brake Adjustment

1 Disengage the parking brake (lever horizontal).

2 Turn handle grip **E** clockwise, half a turn.

3 Test the parking brake, refer to Section G **Service Procedures, Parking Brake - Testing**.

4 If the brake fails the test, repeat steps **1**, **2** and **3**. If there is no more adjustment and pin **F** is at the end of its travel get the brake checked by your JCB Dealer.



A347581

Checking the Foot Brake Fluid Level

⚠ WARNING

Faulty brakes can kill. If you have to add oil to the brake reservoir regularly get the brake system checked by your JCB Dealer. Do not use the machine until the fault has been put right.

2-3-2-5

1 Park the machine on firm level ground, engage the parking brake and set the transmission to neutral. Raise and block the loader arms. Lower the backhoe to the ground and stop the engine.

2 Remove the reservoir cap **A** and check the level. The MAX and MIN marks are marked on the side of the reservoir **B**. If necessary, add fluid as in Step 3.

If the level has fallen below the MIN mark, get the system checked by your JCB Dealer.

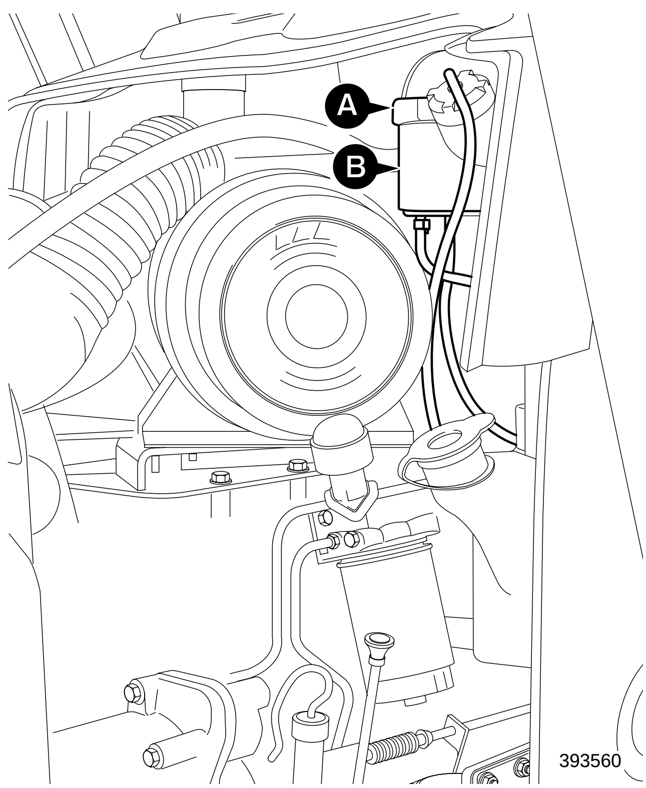
⚠ WARNING

Using incorrect brake fluid could damage the system. See *Service Capacities and Lubricants* in MAINTENANCE Section. The fluid can harm your skin. Wear rubber gloves. Cover cuts and grazes.

4-3-2-3

3 If required, carefully pour the recommended fluid (DO NOT USE ORDINARY BRAKE FLUID) until it reaches the correct level.

4 Refit the reservoir cap. Wipe up any spillage.



393560

Checking the Differential Oil Level

1 Prepare the Machine

Park the machine on level ground. Engage the parking brake. Set the transmission to neutral. Lower the attachments to the ground. Stop the engine and remove the starter key.

2 Check/Add Oil

Clean the area around the fill/level plug **A**, then remove the plug and its sealing washer. Oil should be level with the bottom of the hole. Add recommended oil, if necessary. See **Fluids, Lubricants, Capacities and Specifications** for recommended oil. Clean the plug and sealing washer before refitting them.

Changing the Differential Oil

1 Prepare the Machine

Park the machine on level ground. Engage the parking brake. Set the transmission to neutral. Lower the attachments to the ground. Stop the engine and remove the starter key.

2 Drain the Oil

a Place a container of suitable size beneath plug **B** to catch the oil. See **Fluids, Lubricants, Capacities and Specifications** .

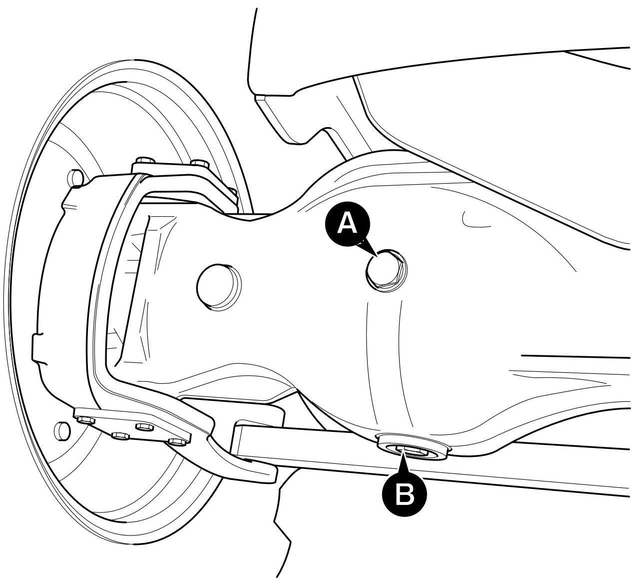
b Remove fill/level plug **A** and drain plug **B,** together with their bonded washers. Allow time for the oil to drain out.

c Clean and refit drain plug **B** and a new bonded washer. Tighten to 79 Nm (58 lbf ft).

3 Fill with New Oil

a Fill the axle with recommended axle oil through the fill/level hole **A.** Oil should be level with the bottom of the fill/level hole. See **Fluids, Lubricants, Capacities and Specifications**.

b Clean and refit fill/level plug **A** and a new bonded washer.



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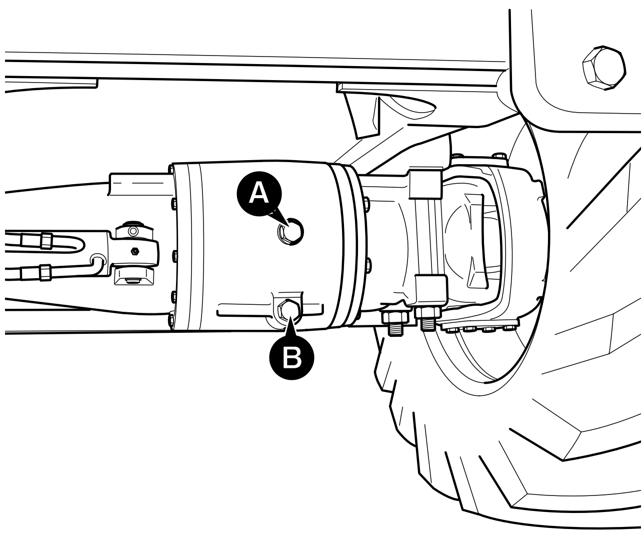


391700

Checking the Hub Oil Levels

Check each hub separately.

1 Park the machine on level ground with the **OIL LEVEL** mark horizontal. There is a tolerance of 5 mm (0.2 in) above or below the horizontal.

Engage the parking brake. Set the transmission to neutral. Lower the attachments to the ground. Stop the engine and remove the starter key.

2 Clean the area around the fill/level plug **C**. Remove the plug. Oil should be level with the bottom of the hole. If necessary, add recommended oil. See **Fluids, Lubricants, Capacities and Specifications** for recommended oil. Clean the plug before refitting it.

Changing the Hub Oil

The axle oil is used to lubricate the brake components and cool the brake plates.

It is important that the oil is changed regularly as specified in the service schedule - the lubricating properties of the oil will reduce as a result of brake wear.

Consult your JCB distributor for advice if necessary.

1 Set the machine level, with the tyres just clear of the ground. Manually rotate the wheels to bring the **OIL LEVEL** mark on the hubs to the vertical position, with the fill/level plugs **C** at the bottom.

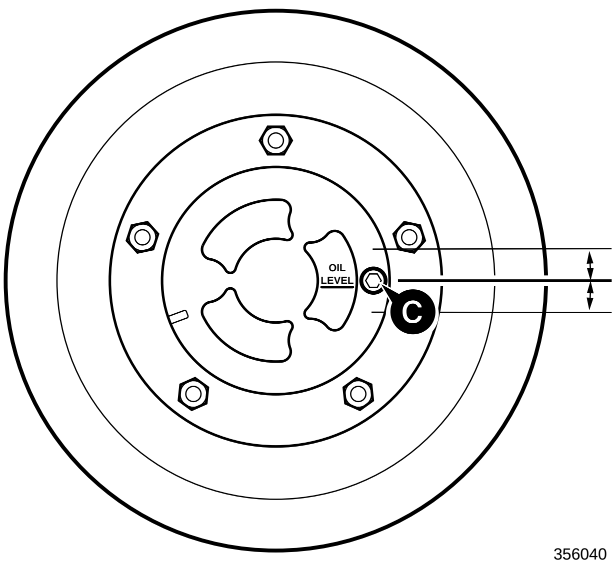
2 Place a container of suitable size beneath plug **C** to catch the oil. See **Fluids, Lubricants, Capacities and Specifications**.

Remove fill/level plugs **C**. Allow time for the oil to drain out.

3 Set **OIL LEVEL** marks to the horizontal. There is a tolerance of 5 mm (0.2 in) above or below the horizontal.

Fill the hubs with recommended axle oil, through the fill/level holes **C**. See **Fluids, Lubricants, Capacities and Specifications**. Oil should be level with the bottom of the fill/level hole.

4 Clean and refit fill/level plugs **C**.



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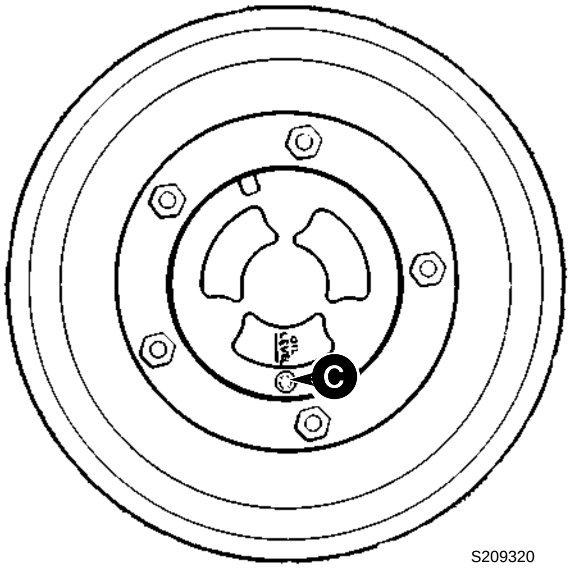


S209320

⚠ WARNING

Fine jets of hydraulic fluid at high pressure can penetrate the skin. Do not use your fingers to check for hydraulic fluid leaks. Do not put your face close to suspected leaks. Hold a piece of cardboard close to suspected leaks and then inspect the cardboard for signs of hydraulic fluid. If hydraulic fluid penetrates your skin, get medical help quickly.

INT-3-1-10/1

Checking the Fluid Level

1 Prepare the Machine

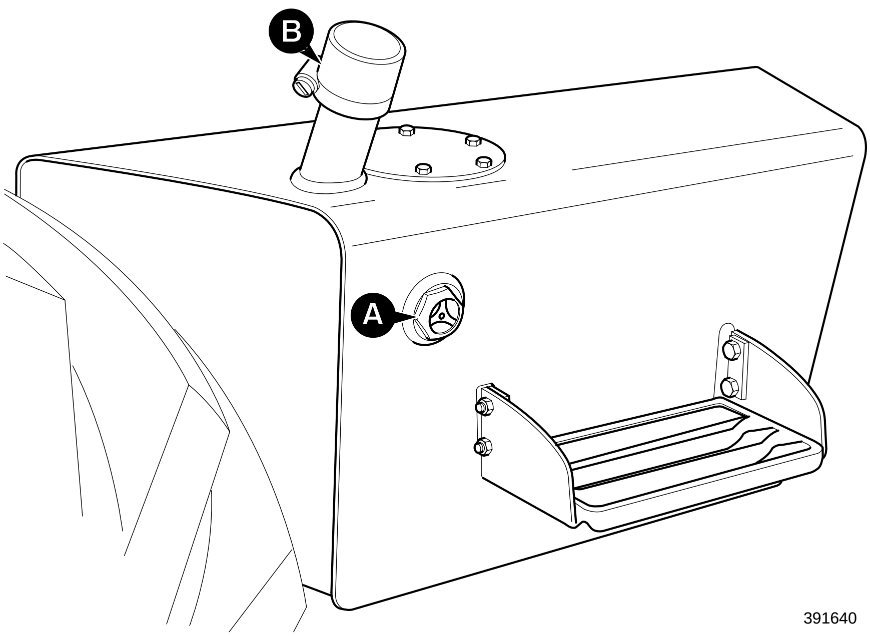
Position the machine on level ground. Set the loader shovel on the ground. Raise the boom, swing in the dipper and close the bucket. Stop the engine. Remove the starter key.

2 Check the Level

Look at the fluid level in the plastic glass **A**. The level should be at the red mark (or above). If the fluid is cloudy, water or air has entered the system. Water or air in the system could damage the hydraulic pump. Contact your JCB distributor if the fluid is cloudy.

3 Add Oil

If necessary, remove filler cap **B** and add recommended oil. See **Fluids, Lubricants, Capacities and Specifications** for recommended oil. Replace filler cap **B** when level is satisfactory.



391640

Changing the Filter Element

⚠ WARNING

Fine jets of hydraulic fluid at high pressure can penetrate the skin. Do not use your fingers to check for hydraulic fluid leaks. Do not put your face close to suspected leaks. Hold a piece of cardboard close to suspected leaks and then inspect the cardboard for signs of hydraulic fluid. If hydraulic fluid penetrates your skin, get medical help immediately.

INT-3-1-10/1

1 Position the machine on level ground. Roll the loader shovel forward and rest it on the ground. Retract the extending dipper if fitted. Close the backhoe bucket. Swing in the dipper. Lower the boom until the bucket rests on the ground. Lower the stabilisers to the ground. Stop the engine. Remove the starter key.

2 Remove screws **A**. Remove the cover plate **B** and gasket **C**, discard the gasket.

3 Remove spring **D**.

4 Hold handle **E** and pull the element assembly from the hydraulic tank.

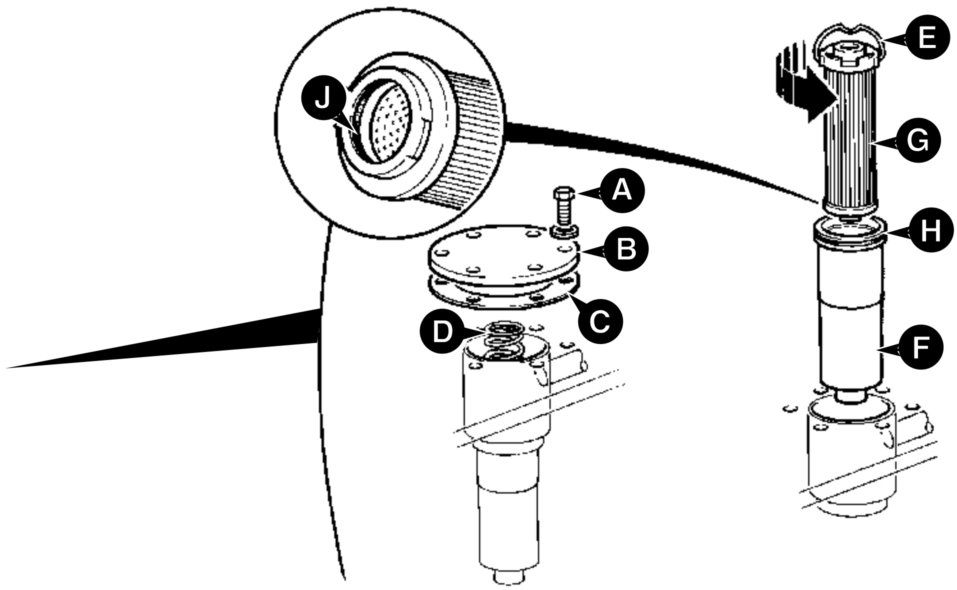
5 Remove the element from its canister.

- **a** Hold canister **F**.
- **b** Hold handle **E** and rotate the element **G** 90° anti-clockwise.
- **c** Pull on handle **E**, the element **G** should separate from its canister **F**. Discard the old element.
- **d** Remove and discard seal **H**.
- **e** Clean the inside of canister **F**.

New machines are fitted with a 5 micron filter element which must be replaced at the first 100 hour service with a 10 micron filter element.

6 Fit the new element.

- **a** Fit a new seal **H**.
- **b** Make sure that seal **J** is fitted in the new element.
- **c** Push the element **G** into its canister **F** and rotate the element 90° to lock it into position. Check that the element has locked into position by pulling on handle **E**.
- **d** Install the element assembly in the hydraulic tank.
- **e** Fit spring **D** and a new gasket **C**.
- **f** Fit cover plate **B** and tighten screws **A** to 10 Nm (7.5 lbf ft).
- **g** Add oil through filler. Fit and tighten the filler cap.



S260301

Fuses

⚠ CAUTION

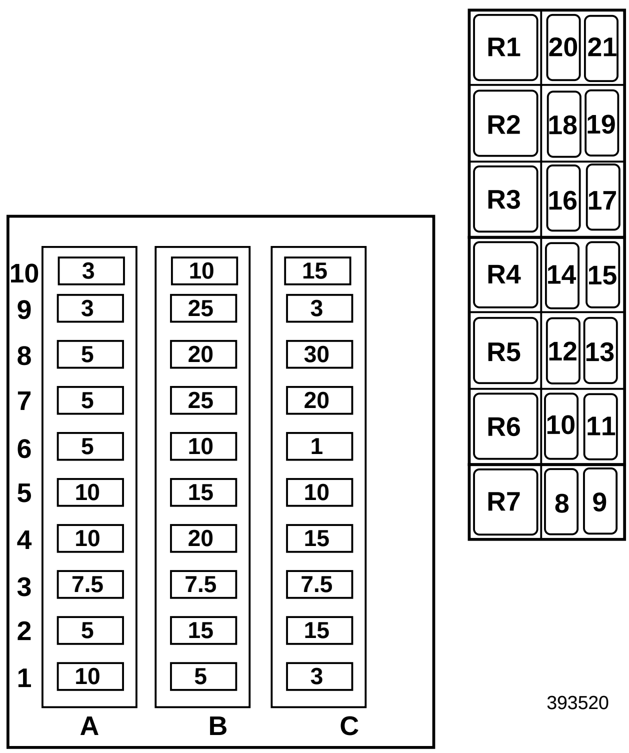
Always replace fuses with ones of correct ampere rating to avoid electrical system damage.
8-3-3-5

The electrical circuits are protected by fuses. The fuses are located in the front console, underneath cover **A**. If a fuse ruptures, find out why and rectify the fault before fitting a new one.

Fuse No.	Circuit	Fuse Rating (Amps)
A1	Junction box, hydraulic tools	10
A2	Engine shut off system	5
A3	Direction indicators	7.5
A4	Creep speed transmission	10
A5	Manual transmission	10
A6	Airmaster (if fitted)	5
A7	Shovel reset, Smooth ride system	5
A8	Brake lights (secondary)	5
A9	Right hand side lights	3
A10	Left hand side lights	3
B1	Tachometer, Gauges	5
B2	Front horn, Front washer/wiper	15
B3	Rear horn	7.5
B4	Auxiliary power socket	20
B5	Rear washer/wiper	15
B6	Brake lights (primary)	10
B7	Rear work lights	25
B8	Lighting, headlights	20
B9	Front work lights	25
B10	Beacon	10
C1	Rear fog light	3
C2	Headlight dip beam	15
C3	Sidelights	7.5
C4	Hazard lights	15
C5	Wiper, Face level fan, Interior light	10
C6	Radio, Hourmeter	1
C7	Thermostart	20
C8	Heater, Air conditioning	30
C9	Starter relays	3
C10	Headlight main beam	15

Relays

R1	Indicators
R2	Front working lights
R3	Rear working lights
R4	Starter 1
R5	Starter 2
R6	Buzzer
R7	Neutral start
R8	Blank
R9	Compressor interlock (Airmaster only)
R10	Compressor shutdown (Airmaster only)
R11	Compressor start (Airmaster only)
R12	Parking brake
R13	Transmission dump
R14	Transmission reverse
R15	Transmission forward
R16	Rear horn
R17	Lights
R18	Brake lights
R19	Blank
R20	Blank
R21	Blank

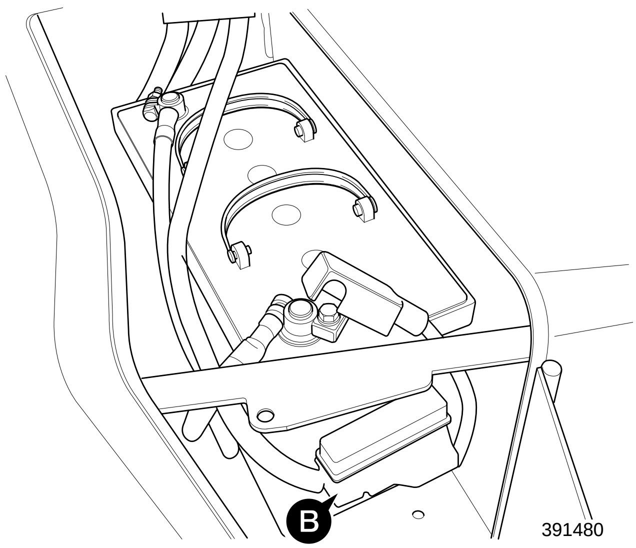


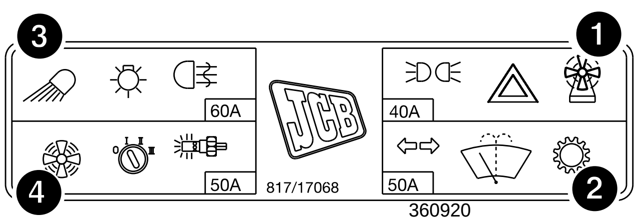
393520

Link Box Fuses

To further protect the machine wiring harnesses and electrical circuits, a fuse link box is fitted to the battery, as shown at **B**. Remember to check the main circuit fuses as well as the link box fuses shown on this page.

1	Hazard warning lights, Side lights, Face level fan	40 Amp
2	Wash/Wipe, Transmission, Indicators	50 Amp
3	Work lights, Fog Lights, Road lights	60 Amp
4	Ignition, Heater, Thermostart	50 Amp





Bulbs	Rating (Watts)
Headlights - main	45 W
Headlights - dip	37.5 W
Indicators	21 W (front & rear)
Instruments	1.2 W
Work lights	55 W Halogen (front & rear)
Number plate light	2 x 5 W
Side/tail lights	5W (front & rear)
Interior lights	10 W
Stop lights	21 W (rear)
Beacon	70 W Halogen
Inspection lamp (where fitted)	55 W (floodlight pattern)
Rear fog	21 W
Warning lights	3 W

Warning Symbols

The following warning symbols may be found on the battery.

Symbol	Meaning
 A289230	Keep away from children.
 A289260	Shield eyes.
 A289280	No smoking, no naked flames, no sparks.
 A289250	Explosive Gas.
 A289240	Battery acid.
 A289270	Note operating instructions.

⚠ CAUTION

Do not disconnect the battery while the engine is running, otherwise the electrical circuits may be damaged.
INT- 3- 1-14

⚠ WARNING

Understand the electrical circuit before connecting or disconnecting an electrical component. A wrong connection can cause injury and/or damage.
INT-3-1-4

⚠ DANGER

Battery electrolyte is toxic and corrosive. Do not breathe the gases given off by the battery. Keep the electrolyte away from your clothes, skin, mouth and eyes. Wear safety glasses.
INT-3-2-1/3

⚠ CAUTION

Damaged or spent batteries and any residue from fires or spillage should be put in a closed acid proof receptacle and must be disposed of in accordance with local environmental waste regulations.
INT-3-1-12

⚠ WARNING

Batteries give off explosive gases. Keep flames and sparks away from the battery. Do not smoke close to the battery. Make sure there is good ventilation in closed areas where batteries are being used or charged. Do not check the battery charge by shorting the terminals with metal; use a hydrometer or voltmeter.
INT-3-1-8

WARNING

Batteries give off an explosive gas. Do not smoke when handling or working on the battery. Keep the battery away from sparks and flames.

Battery electrolyte contains sulphuric acid. It can burn you if it touches your skin or eyes. Wear goggles. Handle the battery carefully to prevent spillage. Keep metallic items (watches, rings, zips etc) away from the battery terminals. Such items could short the terminals and burn you.

Set all switches in the cab to OFF before disconnecting and connecting the battery. When disconnecting the battery, take off the earth (-) lead first.

When reconnecting, fit the positive (+) lead first.

Re-charge the battery away from the machine, in a well ventilated area. Switch the charging circuit off before connecting or disconnecting the battery. When you have installed the battery in the machine, wait five minutes before connecting it up.

First Aid - Electrolyte

Do the following if electrolyte:

GETS INTO YOUR EYES

Immediately flush with water for 15 minutes, always get medical help.

IS SWALLOWED

Do not induce vomiting. Drink large quantities of water or milk. Then drink milk of magnesia, beaten egg or vegetable oil. Get medical help.

GETS ONTO YOUR SKIN

Flush with water, remove affected clothing. Cover burns with a sterile dressing then get medical help.

5-3-4-3/1

Checking the Electrolyte Level

Maintenance free batteries used in normal temperate climate applications should not need topping up. However, in certain conditions (such as prolonged operation at tropical temperatures or if the alternator overcharges) the electrolyte level should be checked as described below.

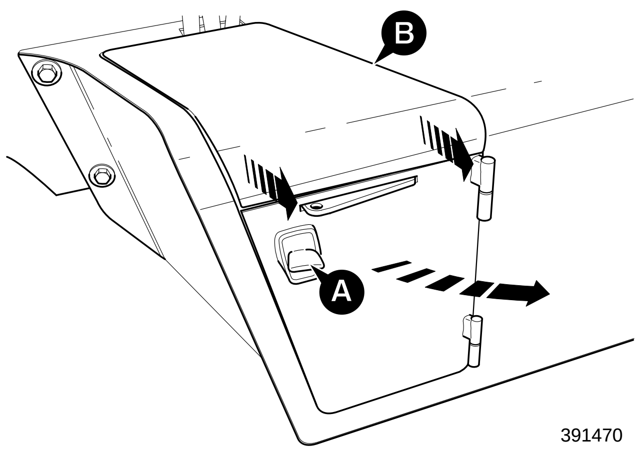
1 Using starter key, turn the key clockwise to unlock the battery cover **A**, lift and remove the cover **B.**

2 Remove the cell covers. Look at the level in each cell. The electrolyte should be 6 mm (1/4 in) above the plates. Top up if necessary with distilled water or de-ionized water. Refit the cell covers and battery cover.

WARNING

Do not top the battery up with acid. The electrolyte could boil out and burn you.

2-3-4-6



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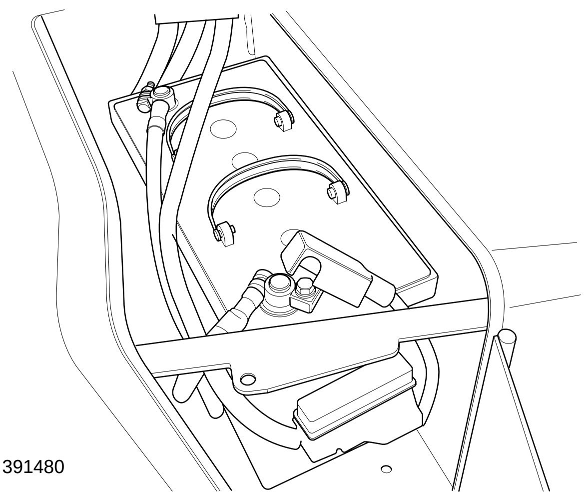


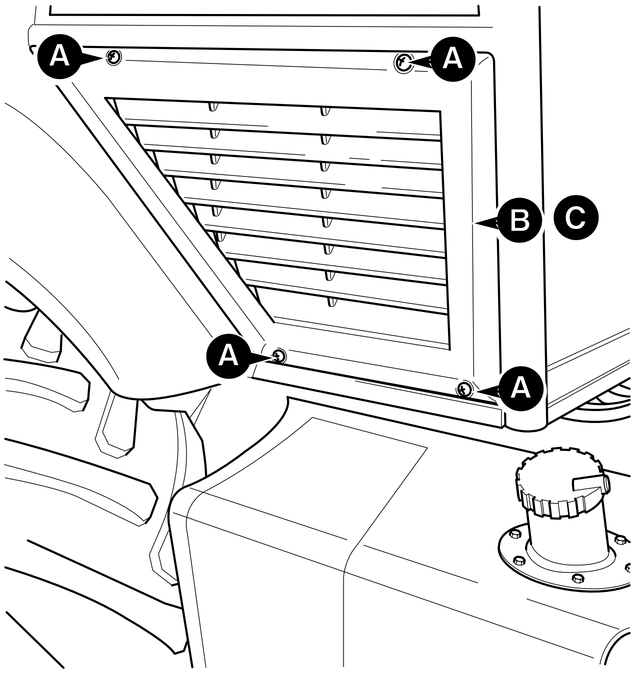
391480

Changing the Recirculation Filter

1 Renew the Filter

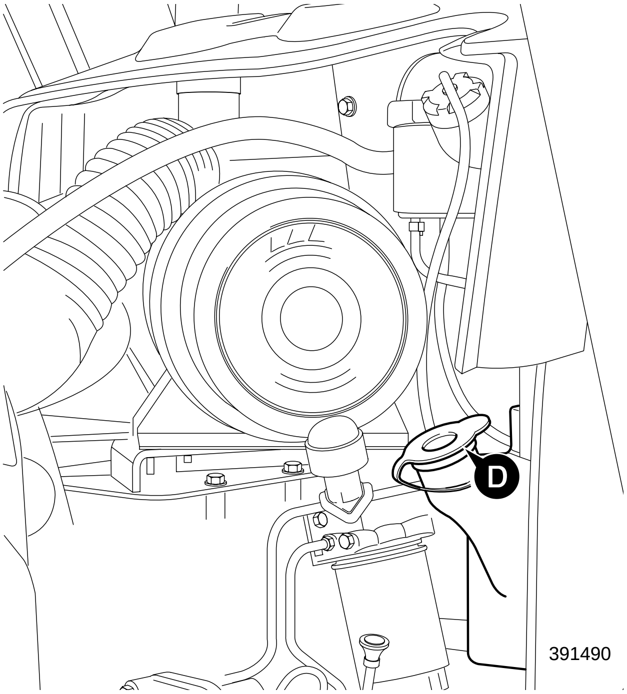
Remove screws **A**, filter cover **B** and filter **C.** Insert a new filter into the filter cover and refit the filter cover.

Note: The recirculation filter may be washed and re-used if in good condition.



391760

Fill the windscreen washer reservoir, through filler cap **D**, with a suitable liquid. The liquid should contain a de-icing fluid to prevent freezing. **Do not use engine coolant antifreeze.**



Wear Pads

The wear pads support and guide the inner leg section. They ensure that during extension and retraction the inner leg is kept central and has a minimum amount of ‘float’.

Upper wear pads **A** (4 off) are fitted to the top of the inner leg as shown. The upper pads are available in sizes 5, 5.5, 6, 6.5 and 7mm. Lower wear pads comprise adjustable pads **B** (2 off) and fixed pads **C** (2 off).

When pads **A** and **C** have worn to a minimum thickness of 0.5 mm (0.020 in.) they must be replaced with new ones. To replace the pads, the stabiliser inner leg must be removed (contact your JCB Distributor).

It is important to note that lower pads **C** are designed to take most of the ‘loading’ during stabiliser leg operation, as a consequence these pads must be checked regularly for wear.

When replacing pads, it is recommended that the complete lower set of pads are replaced (items **B** and **C**). The top pads should be inspected and replaced as required.

Wear Pad Adjustment

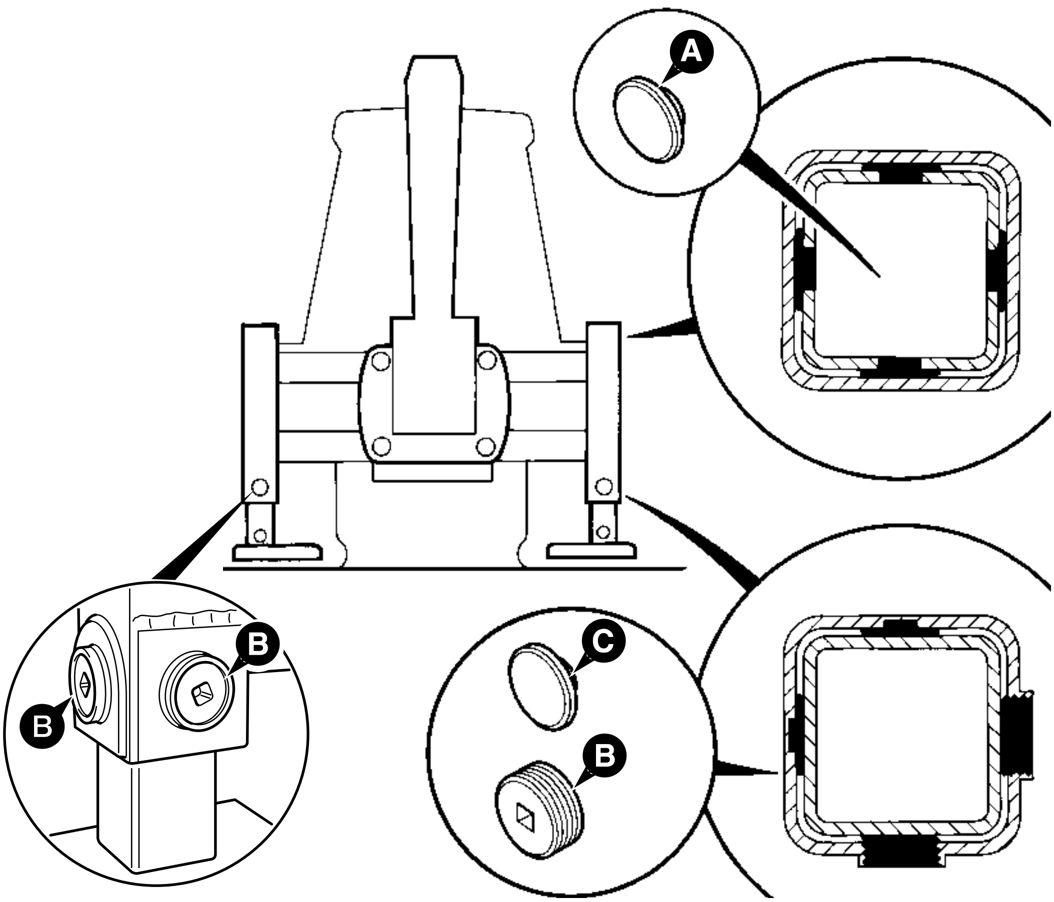
Note: It is very important that the wear pads are adjusted at the correct service intervals, as the inner leg could contact the outer leg and scoring could occur. Scoring will dramatically reduce wear pad life.

As a guide, there should be approximately 1mm (0.039 in.) float between the stabiliser inner and outer leg.

Before adjusting the clearance make sure that the leg is raised clear of the ground but not fully retracted.

To adjust the clearance, screw pad **B** fully in until it just touches the inner leg and then back the pad off by one quarter of a turn.

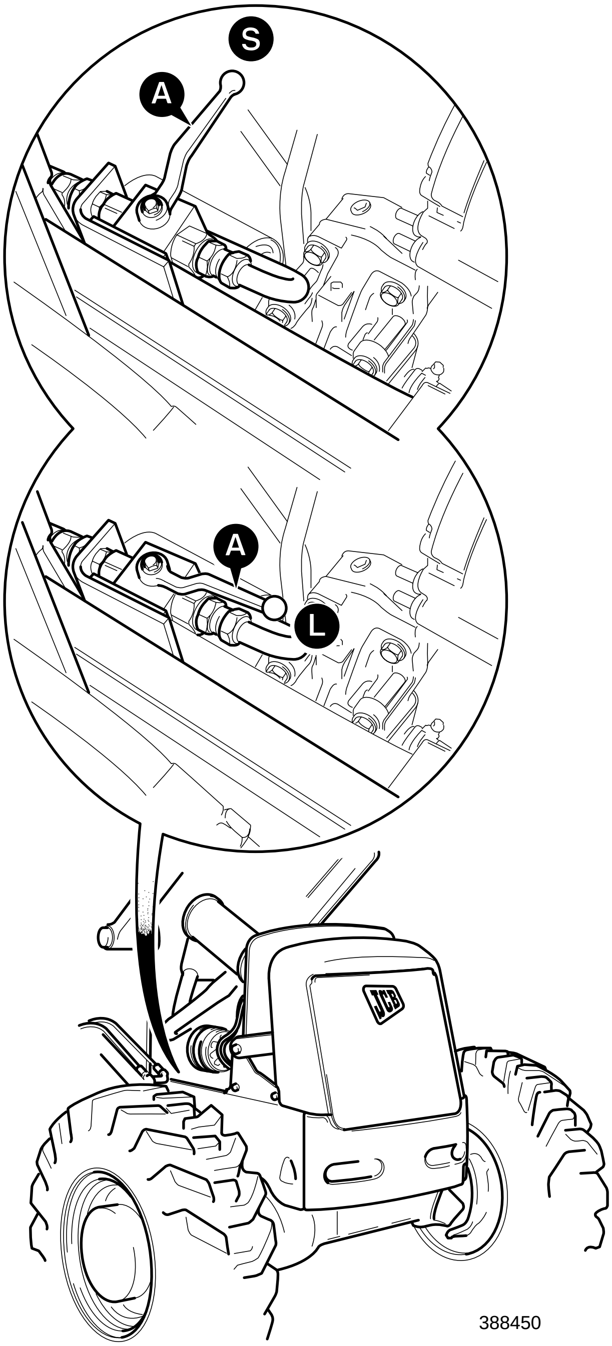
Note: Over-tightening the adjustable pad **B** will lock the pad in position, it will not be possible to back the pad off. If this should happen, operate the stabiliser leg as normal but be aware that pads **B** and **C** will wear more rapidly.



S273120

⚠ WARNING

At the start of each working period, and at least once a day, or if having difficulty in steering, check and, if necessary, re-align the road wheels.
2-1-1-10



388450

1 Start the Engine

2 Turn the Steering Wheel to Full Right Lock

3 Stop the Engine

Remove the starter key.

4 Move the Setting Lever to SET Position

⚠ WARNING

The engine has exposed rotating parts. Switch OFF the engine before working in the engine compartment. Do not use the machine with the engine cover open.
5-2-6-5

- **a** Open the bonnet.
- **b** Move the setting lever **A** to the **SET** position **S** as shown.

5 Start the Engine

6 Continue to Turn the Steering Wheel to Full Right Lock until Full/Maximum Travel is Obtained

7 Stop the Engine.

Remove the starter key.

8 Move the Setting Lever to LOCK Position

- **a** Move the setting lever **A** to the **LOCK** position **L** as shown.
- **b** Close the bonnet.

9 Repeat Steps 1 to 8, if necessary.

⚠ DANGER

The steering setting lever must be in the FULLY LOCK position before driving the machine, failure to do so will result in a loss of steering. The setting lever must not be removed or modified.
5-2-6-6

Note: New engines DO NOT require a running-in period. The engine/machine should be used in a normal work cycle immediately; glazing of the piston cylinder bores, resulting in excessive oil consumption, could occur if the engine is gently run-in. Under no circumstances should the engine be allowed to idle for extended periods; (e.g., warming up without load). Engines of new machines are filled at the factory with JCB 10W/30 Multigrade oil. This oil should be drained after the first 100 hours operation and the engine filled with the appropriate recommended grade as shown in the lubrication chart. JCB 10W/30 Multigrade should also be used for the first 100 hours operation whenever a new or reconditioned engine is fitted to the machine. After the first 100 hours operation, it is essential that the 10W/30 oil is replaced by the lubricant recommended below.

ITEM	**CAPACITY Litres (UK Gal)**	**FLUID/LUBRICANT SPECIFICATION**	**INTERNATIONAL**
Fuel Tank	83.2 (18.3)	Diesel Oil (See **Types of Fuel**)	ASTM D975-66T Nos. 1D, 2D
Engine (Oil)	11.1 (2.5)	**JCB 15W/40 Multigrade** -10 °C to 50 °C (14 °F to 122 °F) **JCB Super Universal Agricultural** -15 °C to 30 °C (5 °F to 86 °F) **JCB Torque Converter Fluid** -18 °C to 0 °C (0 °F to 32 °F)	SAE15W/40 API CD/SE SAE10W/30 API CD/SE SAE10W API CD/SE
Engine (Coolant)	12.0 (2.6)	**JCB Four Seasons Antifreeze & Summer Coolant/Water** (See **Coolant Mixtures**)	ASTM D3306-74
Syncro Shuttle	17.5 (3.8)	**JCB Special Transmission Fluid** Friction modified oils MUST NOT be used (eg. Dexron ATF type)	ESP-M2C 33G
Axles			
Housing (Front)	11 (2.4)	**JCB Special Gear Oil Plus**	API-GL4
Housing (Rear)	15.5 (3.4)	Must be suitable for use with oil immersed brakes and limited slip differentials (LSD).	
Hubs (x4)	1.8 (0.4)		
Hydraulic System ①	58 (12.75) (tank capacity)	**JCB High Performance Hydraulic Oil** (Above 38 °C, 100 °F) **JCB Special Hydraulic Fluid** (Below 38 °C, 100 °F)	ISO VG46 ISO VG32
Extending Dipper **Stabiliser**		**Waxoyl** ③	
Grease Points	---	**JCB HP Grease**	Lithium complex NLGI No. 2 consistency including extreme pressure additives.
	---	or **JCB Special MPL-EP Grease** ②	Lithium based NLGI No. 2 consistency including extreme pressure additives.
Electrical Connections		As a corrosion and moisture inhibitor all exposed connections should be coated with petrol jelly.	

① **Note:**The total hydraulic system capacity depends on the equipment being used. Fill with all rams closed. Watch level indicator on hydraulic tank.

② JCB HP Grease is the recommended specification grease, if using JCB MPL-EP then the greasing must be carried out more frequently.

③ **WARNING:** Waxoyl contains turpentine substitute, which is inflammable. Keep flames away when applying Waxoyl. Waxoyl can take a few weeks to dry completely. Keep flames away during the drying period. Do not weld near the affected area during the drying period. Take the same precautions as for oil to keep Waxoyl off your skin. Do not breathe the fumes. Apply in a well-ventilated area.

GEN-1-3

Coolant Mixtures

WARNING

Antifreeze can be harmful. Obey the manufacturers instructions when handling neat or diluted antifreeze.

7-3-4-4

The protection provided by JCB Four Seasons Antifreeze is shown below. If any other anti-freeze is used, refer to the manufacturers' instructions and ensure that a corrosion inhibitor is included. DO NOT use solutions of more than 60% or less than 50% or damage to the cooling system will occur.

55% Solution - Maintains circulation down to -36 deg C (-33 deg F), Protects against damage down to -41 deg C (-42 deg F)

The strength of the anti-freeze solution must be checked at least once a year, preferably at the beginning of the cold period. It is an advantage to leave the anti-freeze in all the year round as it gives continued protection against corrosion. Always renew the anti-freeze every two years. A 50% anti-freeze mixture must be used even if frost protection is not needed. This gives protection against corrosion and raises the coolant's boiling point.

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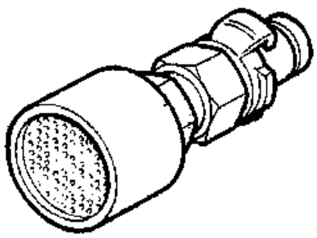
Continued...

Contents Page No.

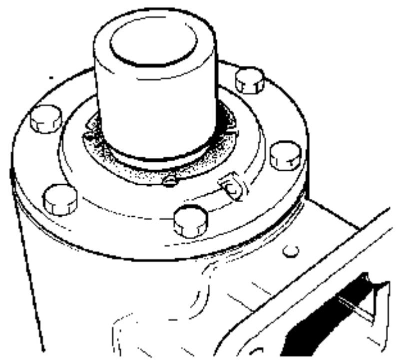
Airmaster Compressor Attachment - *Continued*

892/00877 Airmaster, Air Test Silencer - safety device, attach to air delivery cocks when cocks are to be opened with no hose attached.



S254270

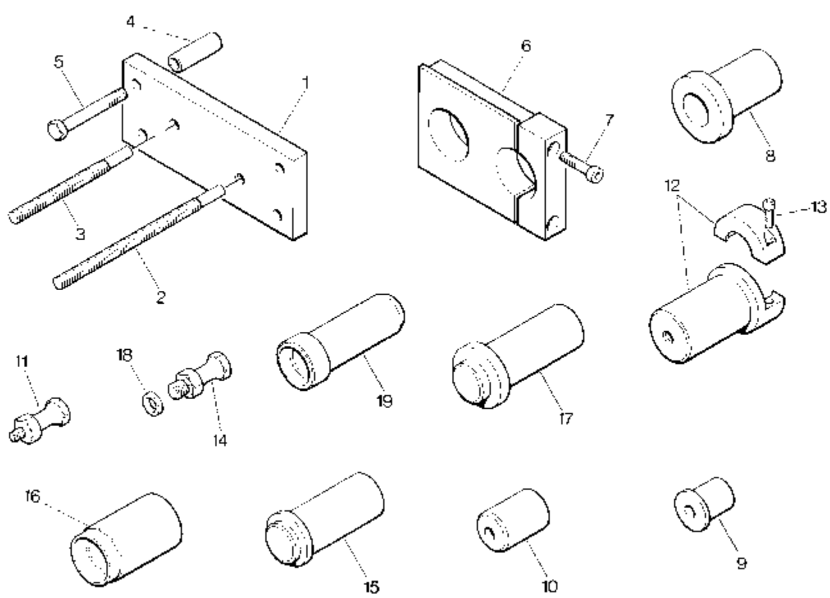
892/00878 Airmaster, Diaphram Assembly Tool - Suction Unloader, tool shown in position



S251870

Airmaster Compressor Service Tool Kit

1 Plate - Bearing and Rotor Removal
2 Stud (long) - Bearing and Rotor Removal
3 Stud (short) - Bearing and Rotor Removal
4 Spacer (Plate) - Bearing and Rotor Removal
5 Bolt (M8 X 110)
6 Clamp - Rotor Locking
7 Screw (M10 X 45)
8 Bridge - Rotor Assembly
9 Extractor - Ball Bearing
10 Clamp - Seal Assembly Tool
11 Sling Pin - R.H.
12 Puller - Inner Bearing and Sleeve
13 Screw (M8 X 25)
14 Sling Pin - L.H.
15 Drift - Oil Seal
16 Drift - Oil Seal
17 Drift - Roller Bearing
18 Washer - Sling Pin L.H.
19 Drift - Roller Bearing - Inner

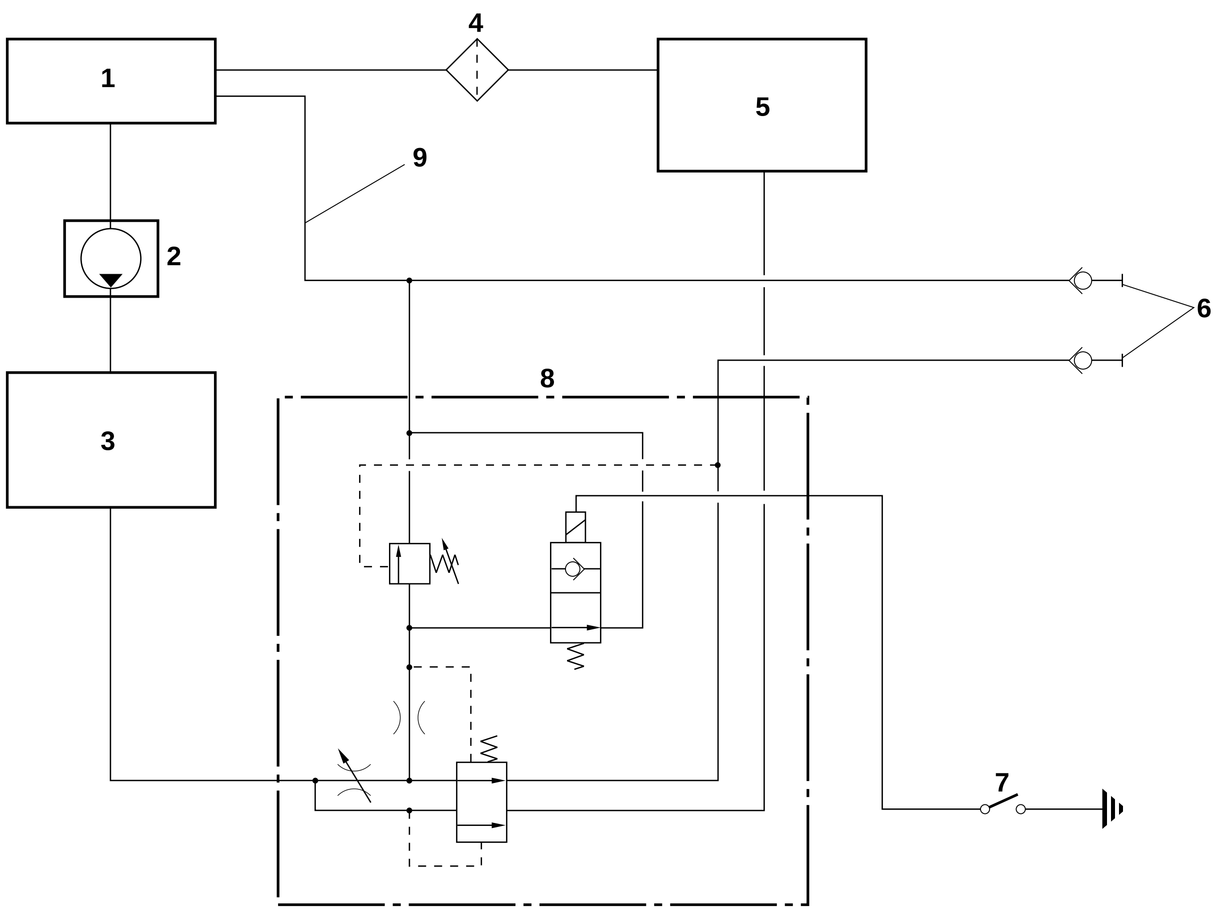


S212010

Schematic Hydraulic Circuit

Component Key

1 Hydraulic Tank
2 Pump
3 Loader Valve Block
4 Filter
5 Excavator Valve Block
6 B.H.T.M.A. Class 'C' Quick Release Couplings
7 Auxiliary Tool Switch
8 Priority Flow Divider
9 Hi-flow Return Line



A173420

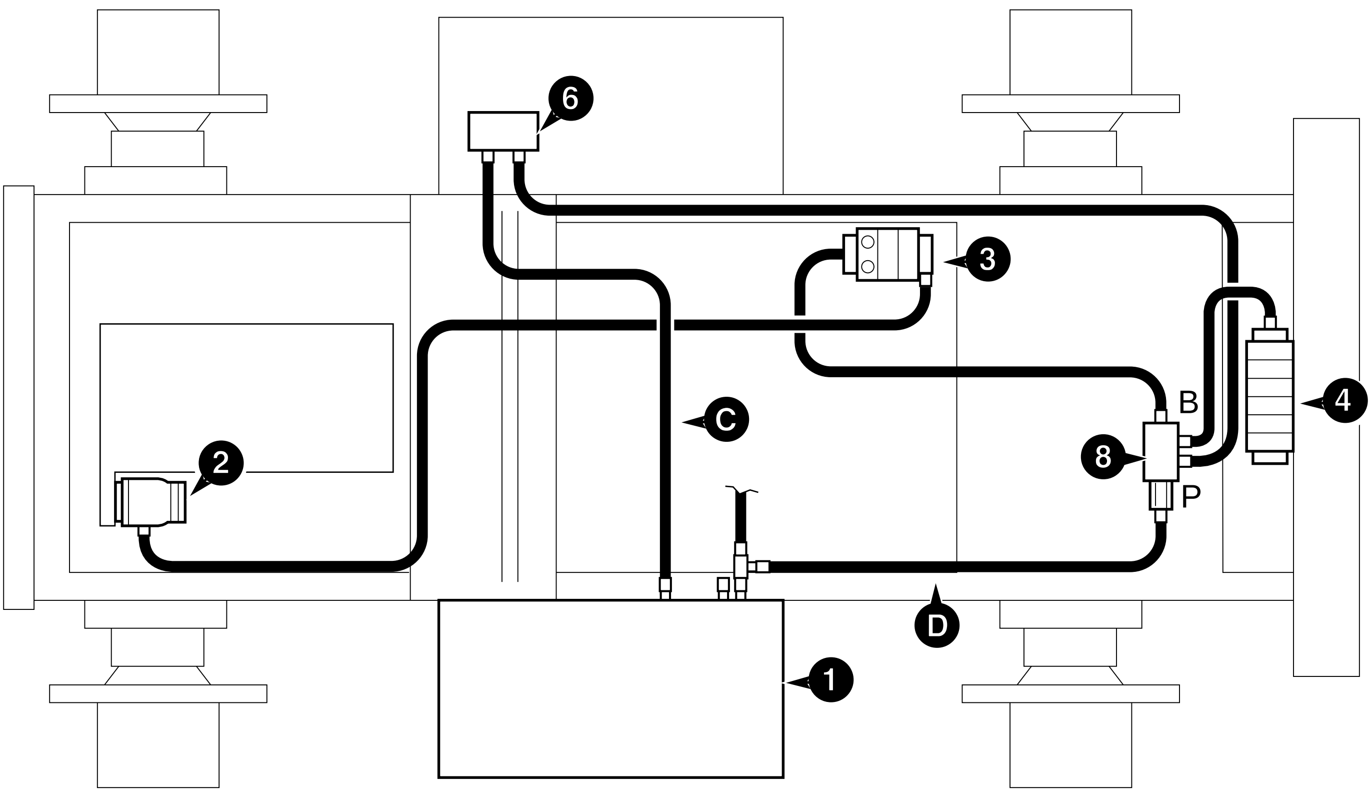
A173420

Circuit Description

Oil from the hydraulic pump **2** enters the loader valve **3** (brake and steer circuits not shown). From the loader valve, the oil passes to flow diverter valve **8**. This valve establishes a priority (and controlled) flow to the hydraulic tool circuit (HTC), if the hydraulic tool circuit (HTC) has not been selected, the oil passes from port **B** of valve **8** to the backhoe valve **4**. From the backhoe valve the oil returns to the hydraulic tank **1** via an in-line filter (not shown).

When the hydraulic tool circuit (HTC) is selected, a solenoid inside the diverter valve **8** is energised, this causes the flow of oil inside the valve to be diverted to port **P** and on to the hydraulic tool circuit (HTC) via quick release couplings **6**. Oil returning from the circuit returns directly to tank **1** via hose **C**. The flow of oil from port **P** is regulated regardless of changes in load pressure or pump flow. Any excess flow (anything over 20 litres/min) is distributed to port **B** for use in other actuators (e.g. backhoe valve).

The diverter valve **8** also incorporates a relief valve, when the pressure in the priority circuit (port **P**) exceeds the setting of the relief valve all oil flow is returned directly back to tank via hose **D**.



A201040

Flow Diverter Valve

Removal and Replacement

⚠ WARNING

Make the machine safe before working underneath it. Park the machine on level ground, lower the arms. Apply the parking brake, put the transmission in neutral and stop the engine. Chock both sides of all four wheels.

Disconnect the battery, to prevent the engine being started while you are beneath the machine.
GEN-1-2

Removal

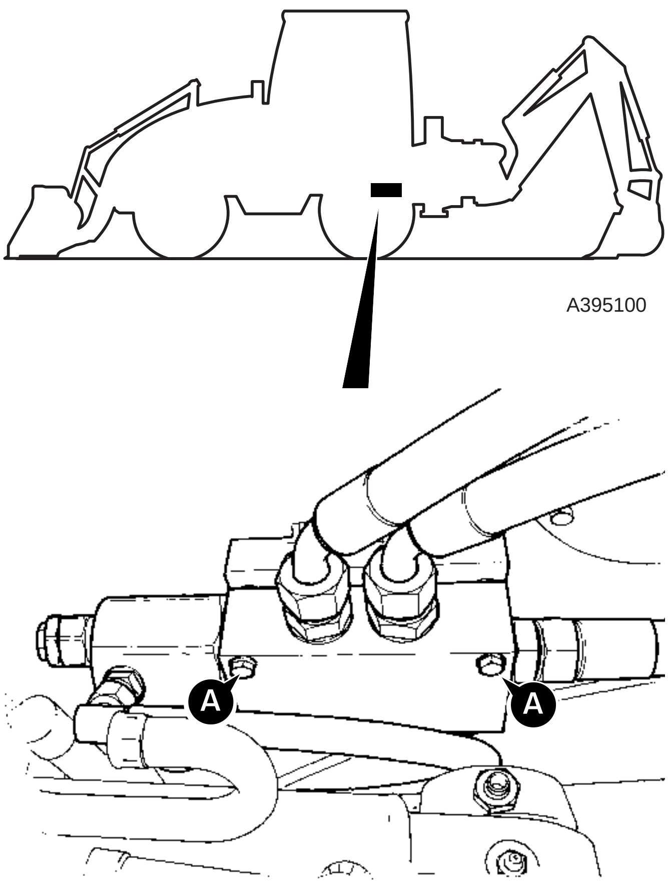
1 Park the machine on firm level ground, engage the parking brake and set the transmission to neutral. Lower the backhoe and loader end to the ground and stop the engine.

2 Operate the loader valve block control levers back and forth to vent residual hydraulic pressure.

3 Disconnect all hydraulic hoses from the valve block and plug all orifices to prevent ingress of dirt. Label each hose before disconnecting, this will ensure correct re-fitting.

4 Remove the electrical solenoid connector.

5 Loosen and remove the two valve retaining bolts **A**.



Replacement

Replacement is a reversal of the removal sequence.

⚠ WARNING

Fine jets of hydraulic fluid at high pressure can penetrate the skin. Do not use your fingers to check for hydraulic fluid leaks. Do not put your face close to suspected leaks. Hold a piece of cardboard close to suspected leaks and then inspect the cardboard for signs of hydraulic fluid. If hydraulic fluid penetrates your skin, get medical help immediately.
INT-3-1-10/1

Make sure that the hoses are correctly installed. The hose connections from the flow diverter valve are as follows:

Port **E** = to the loader valve block.
Port **P** = to the HTC quick release coupling
Port **B** = to the backhoe valve block
Port **T** = to the hydraulic tank

Note: The flow diverter valve ports should be stamped 'E', 'P', 'B' and 'T'.

After replacement check the flow setting and the relief valve pressure settings (see page A/2-5).

Flow Diverter Valve

Dismantling and Assembly

The numerical sequence shown on the illustration is intended as a guide to dismantling.

For assembly the sequence should be reversed.

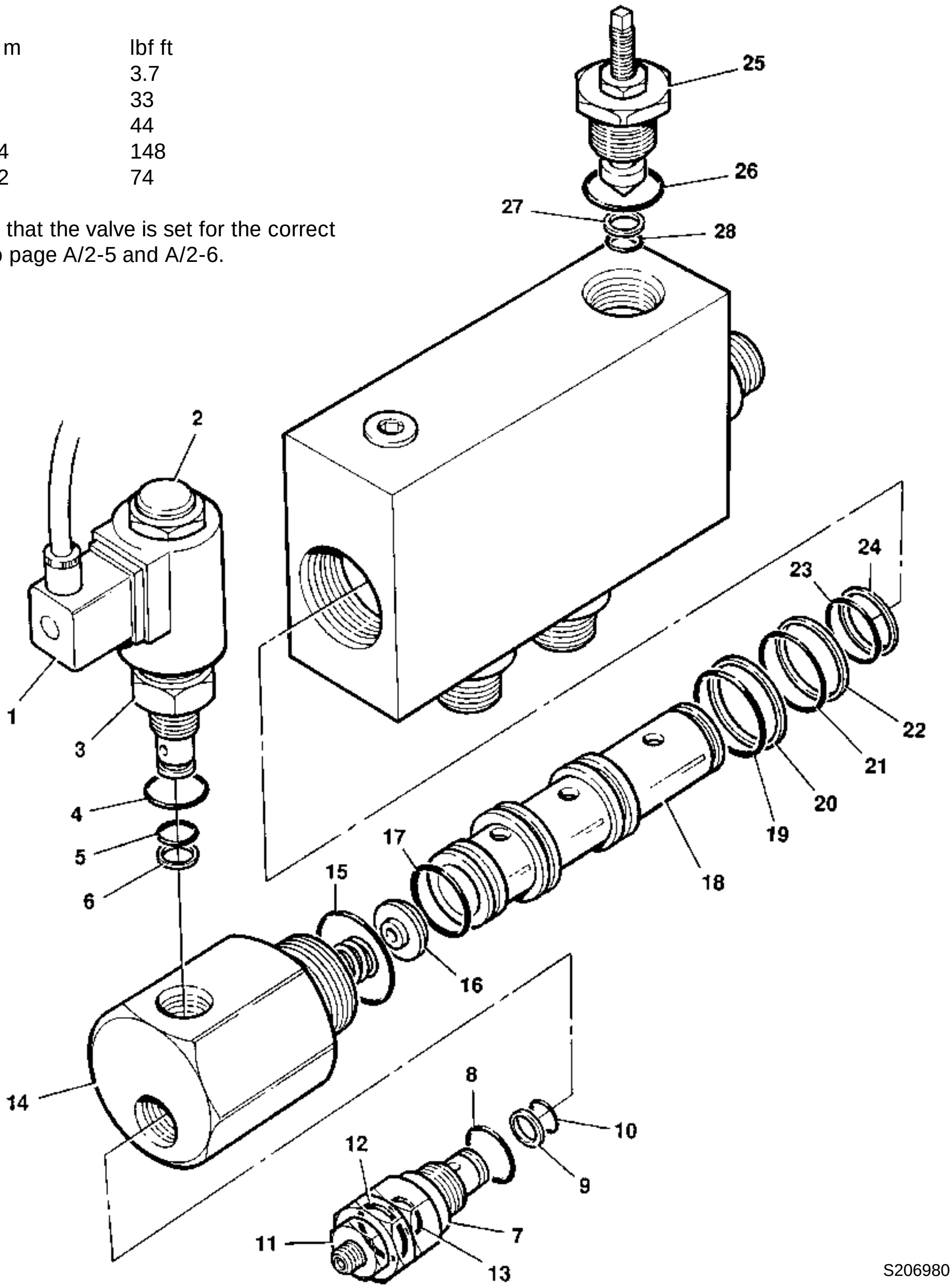
When Assembling

Renew all seals and 'O' rings. Lubricate with JCB Special Hydraulic Fluid.

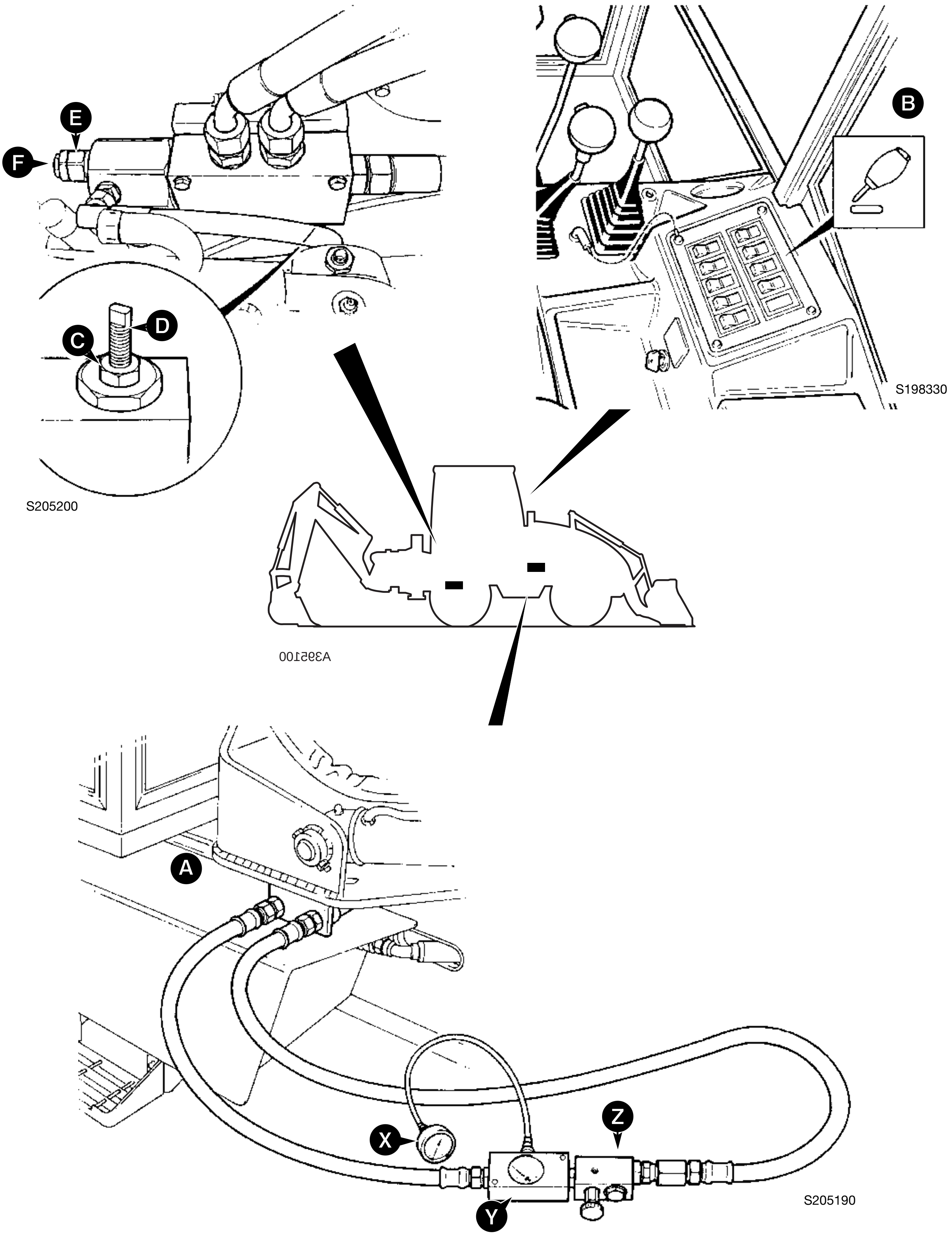
Torque Settings

Item	Nm	kgf m	lbf ft
2	5	0.5	3.7
3	45	4.6	33
7	60	6.1	44
14	200	20.4	148
25	100	10.2	74

After assembly make sure that the valve is set for the correct flow and pressure, refer to page A/2-5 and A/2-6.



Flow Testing & Pressure Testing



Flow Testing & Pressure Testing

⚠ WARNING

Hydraulic Fluid

Fine jets of hydraulic fluid at high pressure can penetrate the skin. Do not use your fingers to check for hydraulic fluid leaks. Do not put your face close to suspected leaks. Hold a piece of cardboard close to suspected leaks and then inspect the cardboard for signs of hydraulic fluid. If hydraulic fluid penetrates your skin, get medical help immediately.

INT-3-1-10/1

⚠ WARNING

Hydraulic Pressure

Hydraulic fluid at system pressure can injure you. Before disconnecting or connecting hydraulic hoses, stop the engine and operate the controls to release pressure trapped in the hoses. Make sure the engine cannot be started while the hoses are open.

INT-3-1-11/1

Prepare the Machine

1 Park the machine on firm level ground, engage the parking brake and set the transmission to neutral. Lower the backhoe and loader end to the ground and stop the engine.

2 Operate the loader valve block control levers back and forth to vent residual hydraulic pressure.

3 **Flow Testing**

a Connect a suitable pressure gauge, flow meter and flow restrictor valve across the flow and return couplings on the machine, as shown at **A**. For reference, items are identified as:

X = Pressure Gauge
Y = Flow Meter
Z = Flow Restrictor Valve

CAUTION: Make sure that the flow restrictor valve **Z** is fully OPEN (the adjusting knob screwed fully out) before starting the engine.

b Start the engine and set the R.P.M. to 1500.

c Enable the HTC circuit, i.e. press the HTC switch **B** to the 'ON' position.

d Note the flow meter reading, the valve should be set at 20 litres/min. If adjustment is required, loosen locknut **C** and turn adjusting screw **D** until the correct flow is obtained.

4 **Pressure Testing**

a Use the flow restrictor valve to pressurise the circuit. As the pressure rises watch the flow reading, it should start to fall when the pressure reaches 138 bar (2000 lbf/in^2)

b If adjustment is required, loosen locknut **E** and turn adjusting screw **F** until the correct pressure is obtained.

5 Stop the engine, vent residual pressure and remove the pressure gauge, flow meter and flow restrictor valve.

Care and Safety

It is expected that users will employ safe working practices and will observe any related legal requirements when operating or overhauling this machine. The following notes augment instructions given elsewhere in this publication and they are intended as a guide to the safe use of this machine and its associated compressed air supply under normal working conditions.

General Safety

⚠ Use only certified pressure vessels of adequate working pressure as air receivers. OTHERS COULD EXPLODE.

⚠ Never operate a compressed air system, for example compressor pipework or pneumatic appliance, at a higher pressure than that for which it has been designed or rated.

⚠ Shut off the air cock at the compressor and release air pressure before disconnecting a hose or line unless there is an automatic valve to give protection at the upstream joint being separated.

Operating Safety

BEFORE STARTING THE COMPRESSOR ENSURE:

⚠ The machine is level and with brakes applied.

⚠ Plant is clean internally.

⚠ All air pressure is released from machine.

⚠ All hoses and tubing in good condition, secure and not rubbing.

⚠ No fluid leaks.

⚠ All fasteners tight.

⚠ Fluid levels correct. Top up only with specified oils/coolants. Filler caps must be tight.

⚠ All electrical leads secure and in good order.

⚠ Fan belt tension correct.

⚠ All guards in place and secure.

⚠ Start and stop procedures are clearly understood. Before starting close air discharge cocks. Refer to the operating instructions.

⚠ Refer also to 'Using the Compressor and Site Safety' on the next page.

Maintenance Safety

BEFORE STARTING ANY WORK ON THE PLANT:

⚠ Park the machine on firm level ground. Engage the parking brake and set the transmission to neutral. Stop the engine and remove the starter key.

⚠ Disconnect battery to ensure that machine cannot be started inadvertently.

⚠ Ensure that all air pressure is completely released from the system.

WHEN WORKING ON THE PLANT:

⚠ Use proper lifting gear of adequate capacity.

⚠ Examine condition of lifting equipment before lifting plant by it.

⚠ Use the correct tools for the job.

⚠ When using a chemical or solvent cleaner, follow the manufacturer's instructions.

⚠ Do not weld or perform any operation involving heat near the oil system. Oil tanks must be completely purged, e.g. by steam cleaning, before such operations.

⚠ Do not weld or in any way modify any pressure vessel.

⚠ Before clearing the machine for use, check test that operating pressures, temperatures and speed are correct and that the controls and shut-down devices work correctly.

Care and Safety (continued)

Using the Compressor Unit and Site Safety

This section explains some techniques for efficient and safe use of the compressor and its attachments. Attention is also drawn to the various safety aspects of operating on site. Read and understand this section before you start working with the compressor. Practise using the attachments until you are completely familiar with the controls and what they do.

Before you start using the compressor, tell your work mates what you will be doing and where you will be working. On a busy site, use a signalman.

Remember that your machine is mobile. Whenever possible, manoeuvre your machine into a position which combines safety with efficiency. If you have to choose, remember that **SAFETY MUST COME FIRST**.

⚠ Fit a non-return valve or a shut-off valve in the delivery line if the compressor is to be coupled in parallel with another compressor or connected to an air supply system.

⚠ Distribution pipework and hoses must be the correct size and suitable for the working pressure involved.

⚠ Do not use frayed, damaged or deteriorated hoses. Always store hoses properly and away from heat sources or direct sunlight. A HOSE FAILURE CAN CAUSE INJURY.

⚠ Use only the correct type and size of hose end fittings and connections. Use clamps of robust construction especially made for compressed air.

⚠ If using compressed air for cleaning down equipment, do so with extreme caution. Take care not to blow debris at yourself or other persons or into machinery. Use eye protection.

⚠ When blowing through a hose or air line, ensure that the open end is held securely. A FREE END WILL WHIP AND CAN CAUSE INJURY. Open the supply air cock carefully and ensure that any ejected particles will be restrained. A BLOCKED HOSE CAN BECOME A COMPRESSED AIR GUN.

⚠ Never apply compressed air to your skin or direct it at another person. Never use compressed air to blow dust and debris from your clothing.

⚠ Do not use air directly from a compressor for breathing purposes, e.g. charging air cylinders, unless the compressor is specifically designed or equipped for this purpose.

⚠ Wear ear muffs when using noisy tools or when blowing out the air line.

During operation:

⚠ Check all pressures and temperatures are correct. Refer to the operating instructions.

⚠ Stop the plant if warning lights show or if gauges register outside normal limits. Untrained personnel must not attempt adjustments.

⚠ Do not refill with fuel while the plant is running. Keep fuel away from hot pipes.

⚠ Do not remove the oil filler cap.

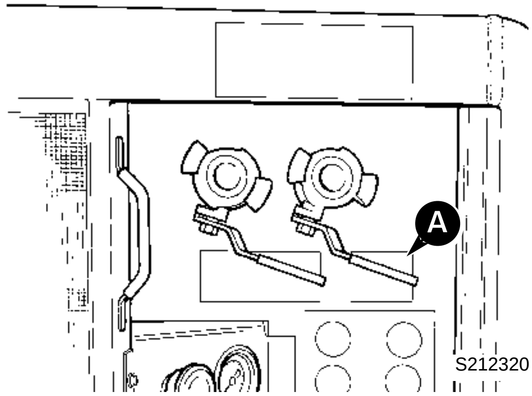
⚠ Do not carry out adjustments inside the canopy when the machine is running other than where specifically instructed.

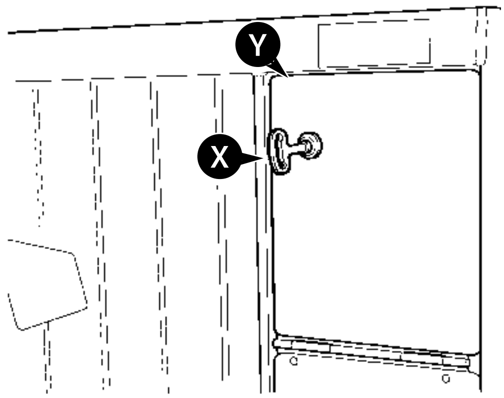
⚠ Do not use the machine in a fire hazard area unless it is suitably equipped. Do not operate in the presence of toxic fumes.

Unit Identification

The air receiver serial number can be viewed through the access hole **A** located in the control console.

The controls are located behind panel **Y**, use the key **X** provided with your machine to open the panel





Safety Decals

⚠ WARNING

Keep all decals clean and readable. Replace lost or damaged decals. Each decal has a part number printed on it, use this to order a new decal.

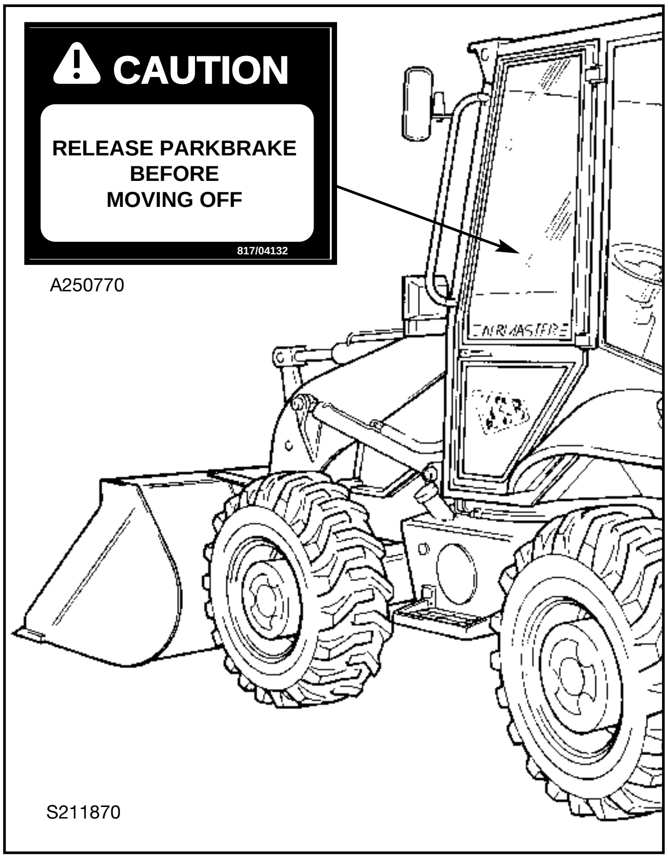
GEN-1-10

⚠ WARNING

Decals

You can be injured if you do not obey the decal safety instructions. Keep decals clean. Replace unreadable or missing decals with new ones before operating the machine. Make sure replacement parts include warning decals where necessary.

INT-1-3-4



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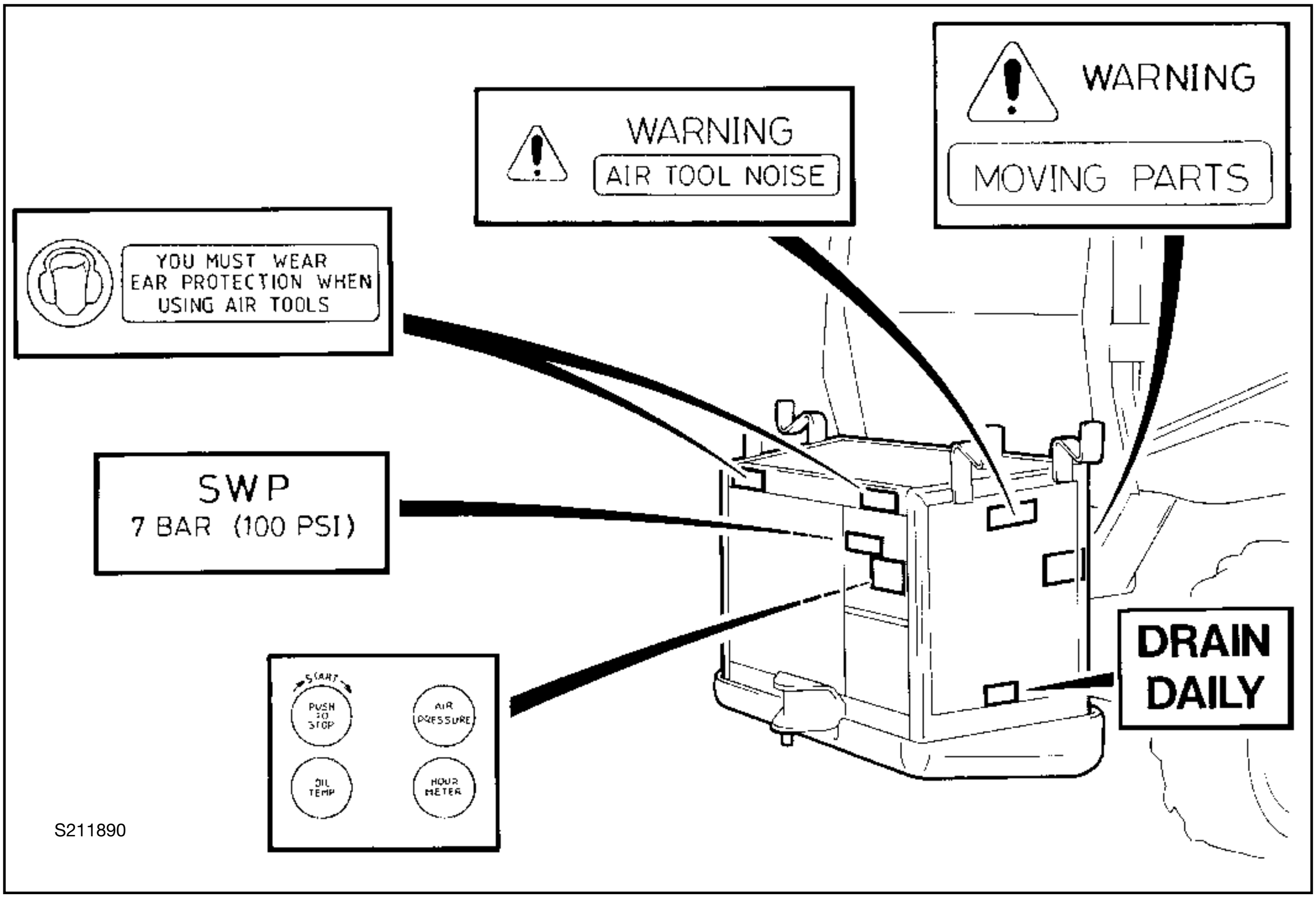


S211890

Routine Maintenance

Compressor Approved Oils

Ambient Temperature Limitations °C

Manufacturer	-20 to +5	-10 to +25	-5 to Maximum Permissible
JCB	**JCB Hydraulic Fluid HP46**	**JCB Hydraulic Fluid HP46**	**JCB Hydraulic Fluid 68**

Service Schedules

Note: Operating hours refer to compressor hours NOT the machine hours

Every 10 Operating Hours (or Daily - whichever occurs first)

Drain
1 Receiver condensate

Check (Engine Stopped)
2 Generally for leaks and damage
3 Receiver oil level

First 100 Operating Hours Only

(New Machines Only)
Do the daily jobs plus:

Change (Engine Stopped)
1 Compressor oil filter element

Check
2 Receiver Cover Bolts (torque to 68 Nm; 50 lbf ft)

Every 100 Operating Hours (or every 2 weeks - whichever occurs first)

Do the daily jobs plus:

Check (Engine Running)
1 Operation of speed control and unloading system
2 Safety valve free to operate

Oil
3 Control panel door hinges

Every 250 Operating Hours (or every 3 months - whichever occurs first)

Do the daily to 100 hour jobs plus:

Check (Engine Running)
1 Safety valve setting

Every 1000 Operating Hours (or 12 months - whichever occurs first)

Do the daily to 250 hour jobs plus:

Clean
1 Flexible oil pipes internally
2 Complete compressor unit using steam
3 Oil cooler

Change
4 Compressor system oil & filter
5 Air filter outer element †

Check (Engine Stopped)
6 Settings of protection circuit switches

Every 2000 Operating Hours (or 2 years - whichever occurs first)

Do the daily to 1000 hour jobs plus:

Change
1 Air filter inner element

† Note: The air filter is linked to the engine shut off system (ESOS), therefore if the filter becomes blocked, the engine will shut down. Change the outer element if the engine shuts down during operation. A new inner element must be fitted at latest every third time the outer element is changed.

Routine Maintenance (continued)

Compressor Air Filter - Changing the Elements

⚠ CAUTION

Do not run the compressor when the outer element has been removed.

⚠ CAUTION

The inner element of the compressor air filter must be replaced with a new one. Do not attempt to clean or wash the old element.

1 Park the machine on firm level ground. Engage the parking brake and set the transmission to neutral. Stop the engine and remove the starter key.

2 Gain access to the filter by opening the side of the compressor housing **X**.

3 If changing the inner element, disconnect the filter induction hose **A**. Cover the end of the hose to prevent rain and dirt from getting into the compressor.

4 Unscrew wingnut **H**. Remove the outer element **G**. Take care not to tap or knock the element.

5 If required, unscrew nut **F** and remove inner element **E**.

6 Clean inside the canister **C** and dust valve **D**.

7 Test the seating of seals **B** and **J**:
- **a** Smear the seals on the new elements with grease.
- **b** Insert the new elements in canister **C**.
- **c** Remove the elements and check for witness marks on the inside base of the canister.

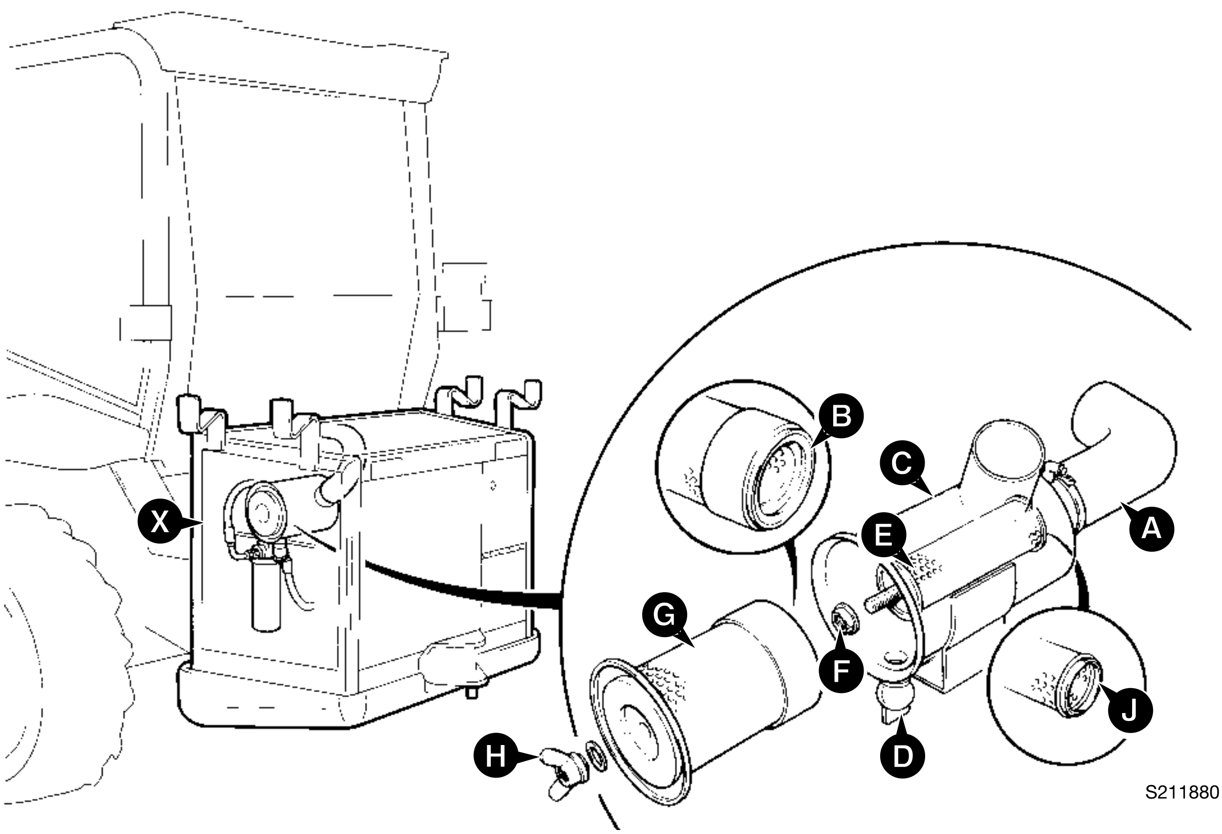
8 If the seals are secure, re-insert the new inner element and tighten nut **F**.

9 Insert the new outer element and tighten wingnut **H**.

10 Refit the induction hose **A** *(if disconnected)*. Make sure that the wire to the Air Filter Blocked switch is attached to the electrical connector.

Note: Do not run the compressor with the dust valve **D** removed.

Note: In dusty conditions, the outer element can be cleaned by blowing through in the reverse direction with clean dry compressed air. If the element is damaged, it must be replaced. A new inner element must be fitted at least every third time the outer element is changed. As a reminder, mark the inner element with a felt tipped pen each time the outer element is changed.



Routine Maintenance (continued)

Compressor Oil and Filter - Draining Air Receiver Condensate

⚠ WARNING

Oil is toxic. If you swallow any oil, do not induce vomiting, seek medical advice. Used engine oil contains harmful contaminants which can cause skin cancer. Do not handle used engine oil more than necessary. Always use barrier cream or wear gloves to prevent skin contact. Wash skin contaminated with oil thoroughly in warm soapy water. Do not use petrol, diesel fuel or paraffin to clean your skin.

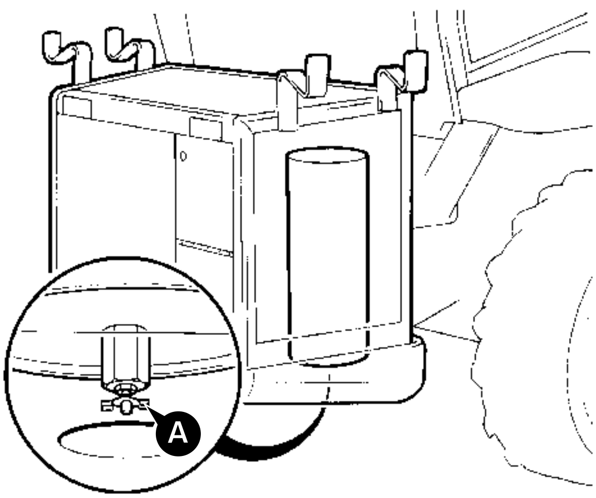
INT-3-2-3

⚠ WARNING

Make sure the machine is safe before getting beneath it. The loader arms must be on the ground, the parking brake engaged and the transmission in neutral. Remove the starter key. Chock the front and rear wheels.

1 Park the machine on firm level ground. Engage the parking brake and set the transmission to neutral. Stop the engine and remove the starter key.

2 Prior to the first compressor start-up each day, open the air receiver oil drain **A** and drain any condensate that may have accumulated; when the flow becomes oil only close the drain promptly.



S211960

Compressor Oil and Filter - Checking Air Receiver Oil Level

⚠ WARNING

Oil is toxic. If you swallow any oil, do not induce vomiting, seek medical advice. Used engine oil contains harmful contaminants which can cause skin cancer. Do not handle used engine oil more than necessary. Always use barrier cream or wear gloves to prevent skin contact. Wash skin contaminated with oil thoroughly in warm soapy water. Do not use petrol, diesel fuel or paraffin to clean your skin.

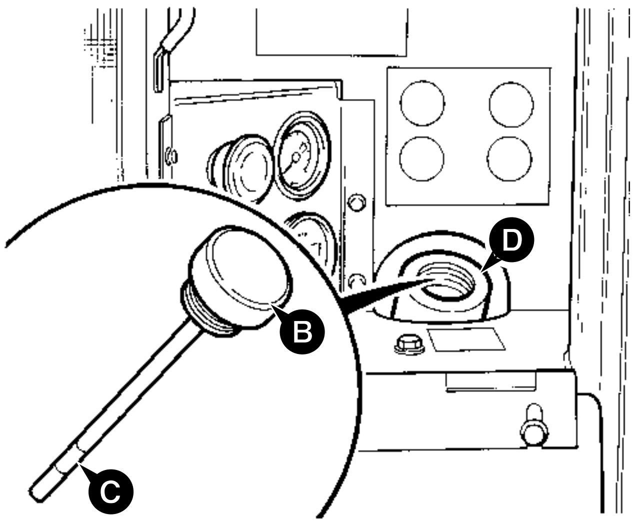
INT-3-2-3

1 Park the machine on firm level ground. Engage the parking brake and set the transmission to neutral. Stop the engine and remove the starter key.

2 Unscrew and remove oil filler/level cap **B**. Check that the oil is between the two marks on the dipstick **C**.

3 If necessary, add oil through filler **D**. It is important to use the same brand and grade of oil as that already being use in the oil system (see ***Compressor Approved Oils***).

4 Replace and secure filler/level cap **B**.



S211900

Routine Maintenance (continued)

Compressor Oil and Filter - Changing Oil and Filter

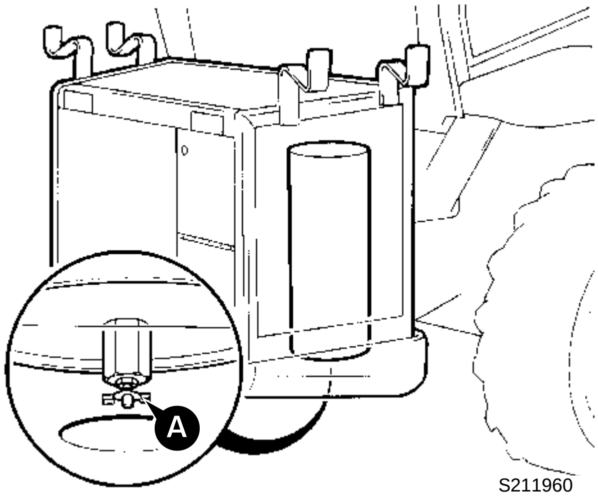
WARNING

Oil is toxic. If you swallow any oil, do not induce vomiting, seek medical advice. Used engine oil contains harmful contaminants which can cause skin cancer. Do not handle used engine oil more than necessary. Always use barrier cream or wear gloves to prevent skin contact. Wash skin contaminated with oil thoroughly in warm soapy water. Do not use petrol, diesel fuel or paraffin to clean your skin.

INT-3-2-3

WARNING

Hot oil can burn you. Make sure the compressor and oil is cool before doing this job.



S211960

1 Park the machine on firm level ground. Engage the parking brake and set the transmission to neutral. Stop the engine and remove the starter key.

2 Remove the air receiver filler/level plug **B**.

3 Place a 23 litre (5 gallon) container under the receiver and open the oil drain **A**.

4 Unscrew the filter canister **E** (if necessary use a strap wrench to help remove the 'spin-on' element). Remember that it will be full of oil.

5 Clean the filter head.

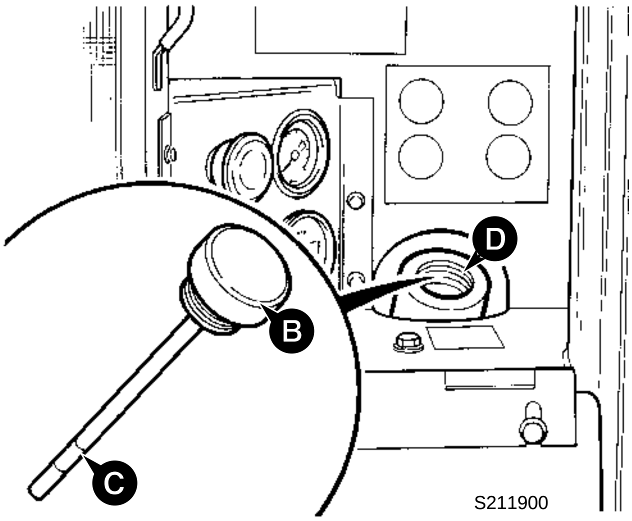
6 Smear the seal of the new filter with compressor oil. Screw on the new filter canister - hand tight only.

7 Close the receiver oil drain.

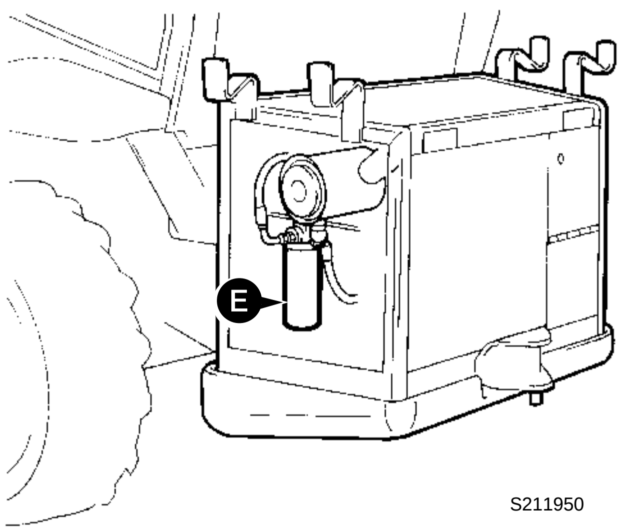
8 Using recommended oil (see ***Compressor Approved Oils***), fill the receiver through filler **D** until oil is just at the maximum level on the dipstick **C**.

9 Replace and secure filler/level cap **B**.

10 Run the plant for ten minutes then shut down. **ENSURE ALL AIR PRESSURE HAS BEEN RELEASED FROM THE RECEIVER**. Wait three minutes for the lubricating oil to settle, then top up again if necessary.



S211900



S211950

Routine Maintenance (continued)

Compressor Oil and Filter - Drying the Separator Element

The air/oil receiver separates the oil from the air/oil mixture after compression has taken place.

In extreme conditions it is possible for the separator element (**A**) to become saturated. This condition could result in oil carry over (oil through tool air lines).

The procedure below describes how to dry out the separator element.

1 Park the machine on firm level ground. Engage the parking brake and set the transmission to neutral.

2 Run the compressor at maximum revs for 10 minutes with the air cocks **B** closed.

⚠ CAUTION

Stand clear and to one side when opening the air cock. Never allow compressed air to be directed to your skin. Compressed air can cause injury to you or others.

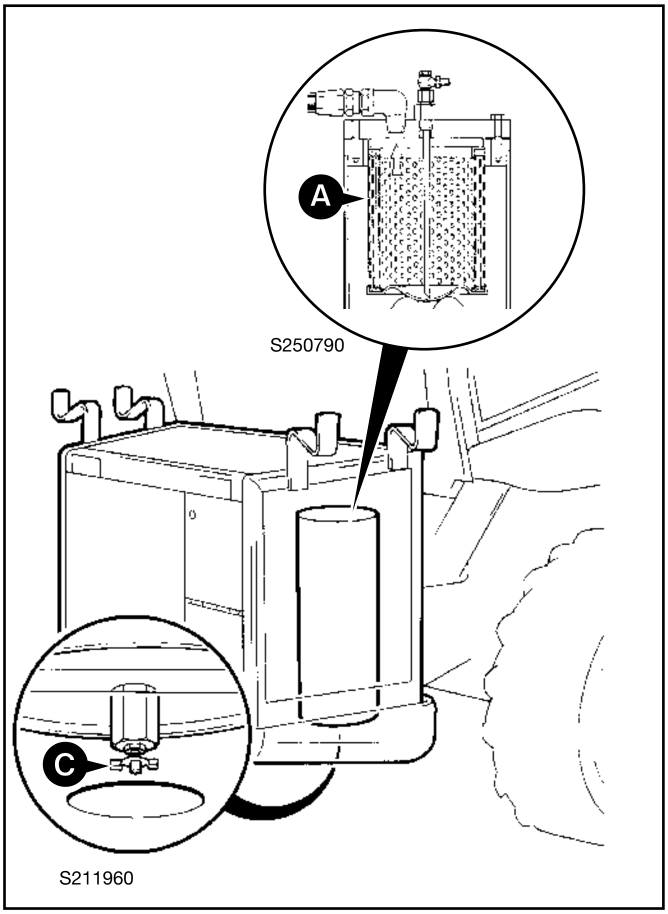
3 Open one air cock slightly without any pressure drop on the gauges, run the compressor at maximum revs for a further 10 minutes.

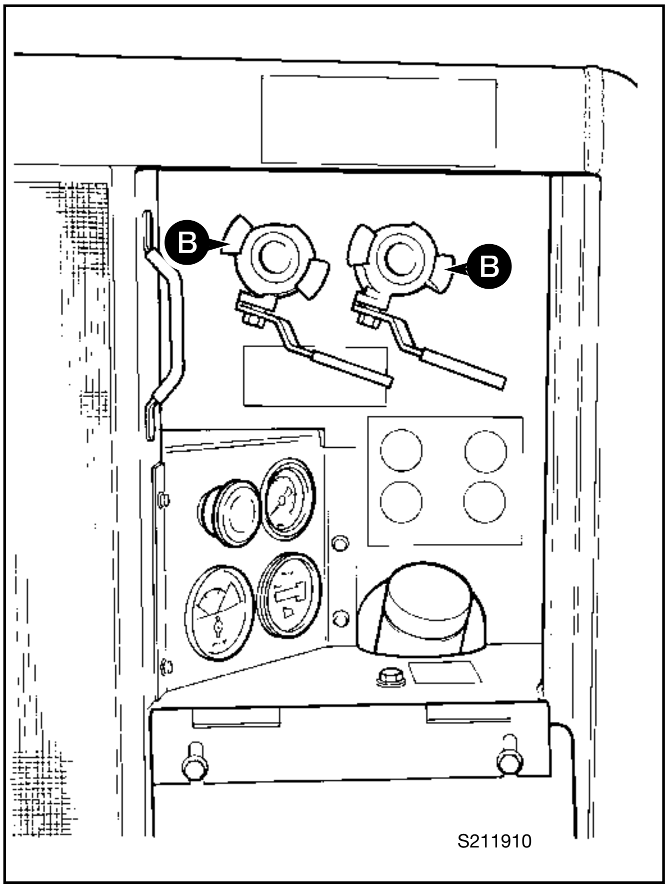
Note: *The above procedures should dry out the separator element and stop oil carry over, however further checks are:*

i *Check the oil level, make sure that the correct grade of oil has been used.*

ii *Drain the separator tank daily (tap **C**).*

iii *Make sure the machine does not work on a steep incline (up to 15% allowed) for an extended length of time.*





Routine Maintenance (continued)

Safety Valve

⚠ WARNING

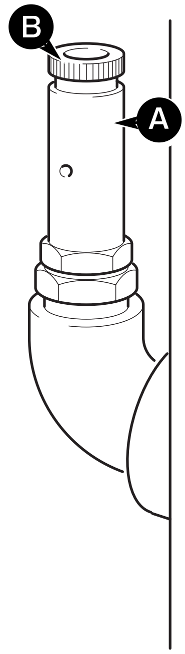
Fine jets of air/oil at high pressure can cause injury. Do not use your fingers to check for leaks. When checking the safety valve operation/setting always beware of escaping air/oil mixture.

Checking Safety Valve Operation

Check the safety valve **A** is free to operate by turning its knurled top cover **B** anti-clockwise until air is discharged from the ports in the base of the valve. Screw the cover down again on completion.

IMPORTANT: The locking wire MUST NOT be broken, the safety valve is set at the factory, if for any reason the safety valve does not work, then it must be replaced as a full unit. The new unit must have the locking wire fitted.

Refer to **Pressure Regulator, 'Checking Safety Valve Setting'** for a description on how to check the safety valve setting.



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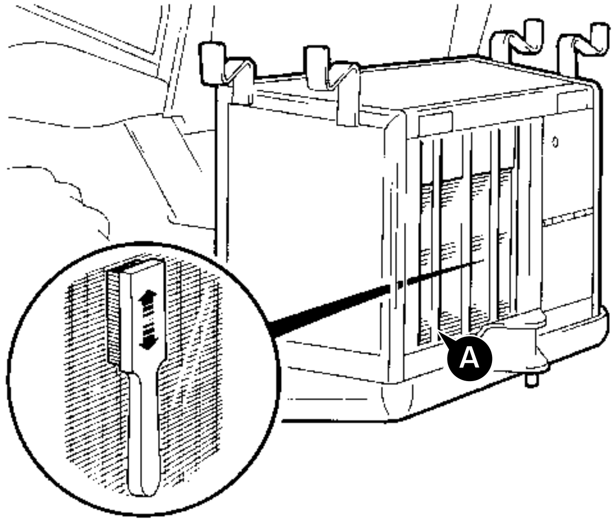
Routine Maintenance (continued)

Cleaning the Oil Cooler



1 Park the machine on firm level ground. Engage the parking brake and set the transmission to neutral. Stop the engine and remove the starter key.

2 Remove the rear grille **A** to gain access to the cooler matrix.

3 Brush off all debris from the cooler tubes and fins. Make sure the loosened material is brushed out of the cooler enclosure.

Technical Data

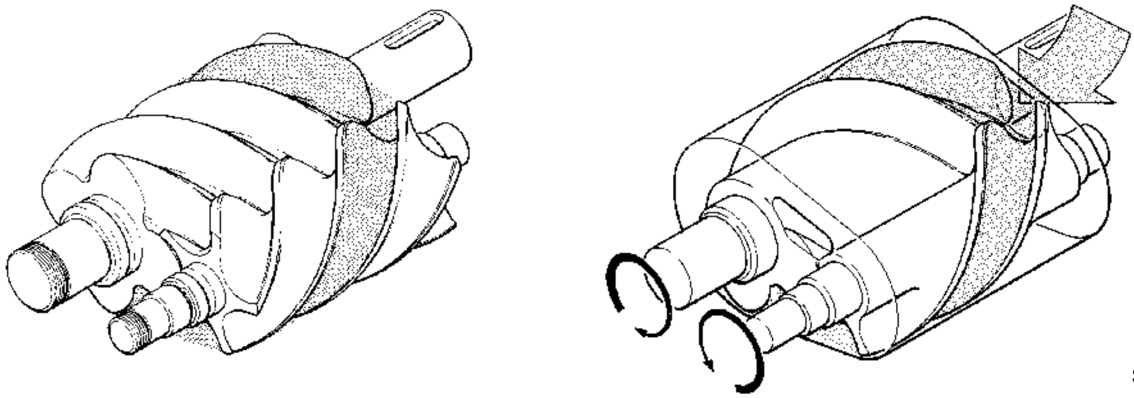
Performance

Maximum working pressure	6.9 bar (100 lbf/in^2)
Rated F.A.D. at full output to ISO 1217	73.2 ltr/sec (4.4 m^3/min, 155 ft^3/min)
Maximum air delivery temperature at full output	
- at compressor unit discharge	120°C (248°F)
- at delivery manifold	110°C (230°F)
Maximum permissible ambient temperature (continuous full load)	50°C (122°F)

Compressor

Air delivery	Two 3/4" BSP Cocks
Air filter	dry paper element
Load control method	speed control and inlet throttling
Oil filter	single bowl, spin-on cartridge type
Method of lubrication	pressure feed to bearings and rotors
Oil cooler	air blast
Oil reclamation	combined kinetic/filtration
Oil system capacity (approx.)	19.5 litre (41/4 imp. gal)

A



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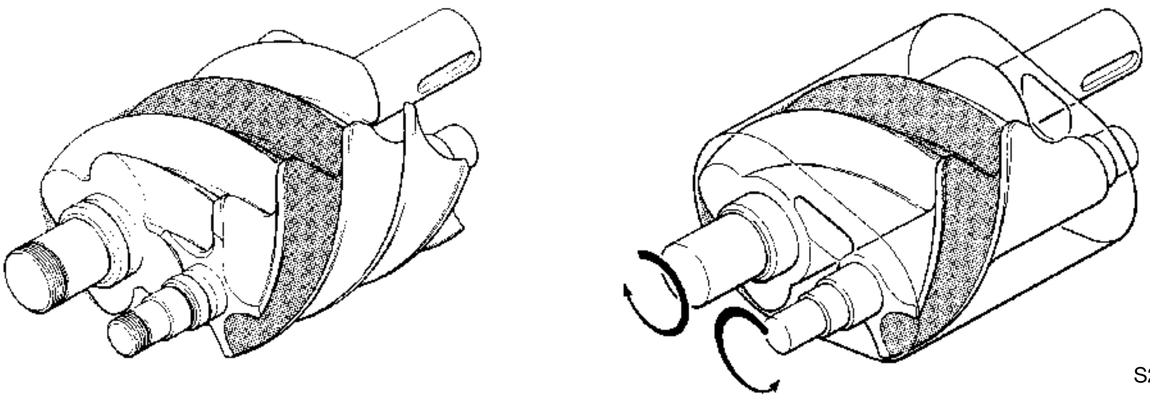
B



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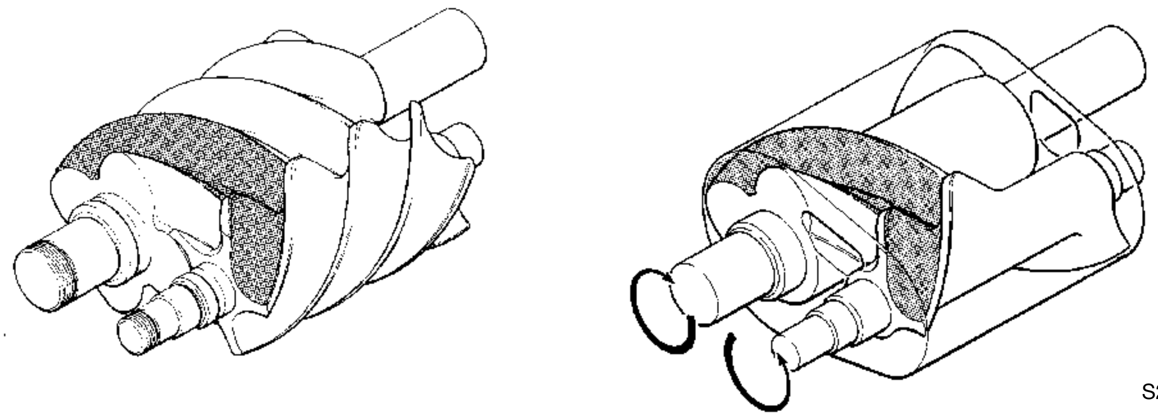
C



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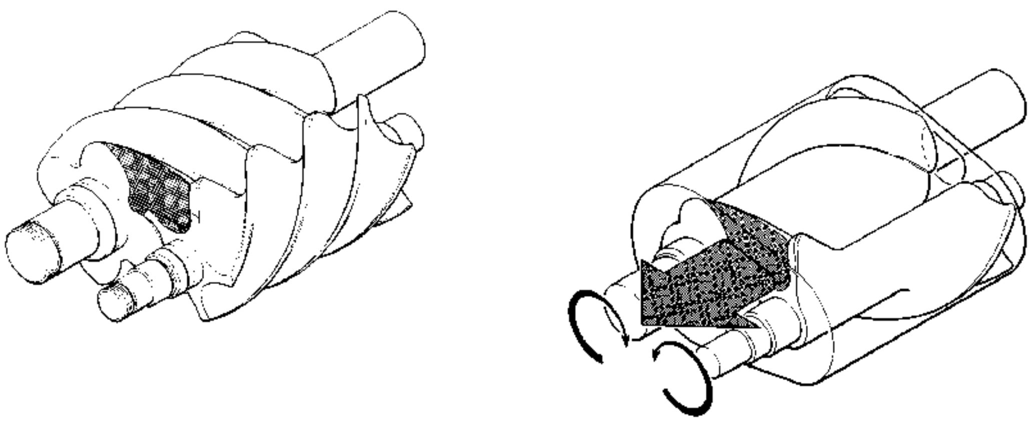


S212090D

Basic Operation

General Description

The compressor is an oil flooded, positive displacement, single stage, rotary screw compressor driven by a power take-off from the transmission gearbox.

The compressor air receiver is constructed in accordance with the appropriate standards for fusion welded pressure vessels. It is fitted with a safety valve, automatic blowdown valve, oil filter, separator and air delivery cocks.

The assembly is fully enclosed within a sheet metal body. The plant is designed to be run with all panels closed except for a door which enables the control panel to be observed.

Compressor Unit

The compressor unit consists of two helical intermeshing rotors contained within the inlet/rotor casing, the male rotor having four lobes and the female six flutes. Each rotor is supported by a pair of combined journal and thrust ball bearings at the delivery end and a roller bearing at the inlet end. The combined journal and thrust bearings provide accurate location of the rotors while the roller bearings permit expansion of the rotors to take place freely and cater for the radial loads at the inlet end. Fine clearances between the end of the rotors and the casing at the delivery end of the compressor unit are accurately maintained under all conditions of operation.

The drive is transmitted from a power take-off on the transmission gearbox via a drive shaft to the female rotor. The helical engagement of the rotors transmits the drive to the male rotor. The oil which is used as a cooling and sealing medium also lubricates the bearings. The oil injected on to the rotors provides a constant film of oil on them preventing contact and wear. The resultant final air delivery temperature is related to the ambient air temperature; refer to Technical Data.

Compression Cycle

As the rotors revolve, air enters the compressor unit by way of the air cleaner unloader and the inlet port, filling the space between the lobes of the male rotor and the flutes of the female rotor **A**. The air is carried around until a male lobe intermeshes with a corresponding female flute. When the air is trapped **B** compression commences and oil which is being continuously injected mixes with the air **C**. Continued rotation of the rotors reduces the volume of air/oil mixture until it is compressed to outlet pressure **D**. At this point the delivery port is uncovered and the mixture passes through an adaptor and air delivery hose to the air/oil receiver. The oil is separated from the air in the receiver and the air passes to the delivery.

Descriptions

Lubrication System

When the compressor is running, the entire system is pressurised and oil is forced from the air/oil receiver **1**, via hose **2** to the oil cooler **3**. The cooled oil then passes through hose **4** and the filter **5** to the compressor **7** and is injected onto the rotors where it mixes with the inlet air at the commencement of compression. The oil cools the air being compressed, seals between the rotors and lubricates the inlet and delivery bearings. Oil from the delivery bearings drops to the bottom of the delivery end cover and returns to the inlet end of the rotors via internal porting, where it rejoins the main oil flow.

After passing through the compressor delivery port, the air/oil mixture is taken via hose **8** to the receiver where separation of the oil from the air takes place.

Component Key

Item	Description
1	Air receiver
2	Hose
3	Oil cooler
4	Hose
5	Oil filter
6	Hose
7	Compressor
8	Hose

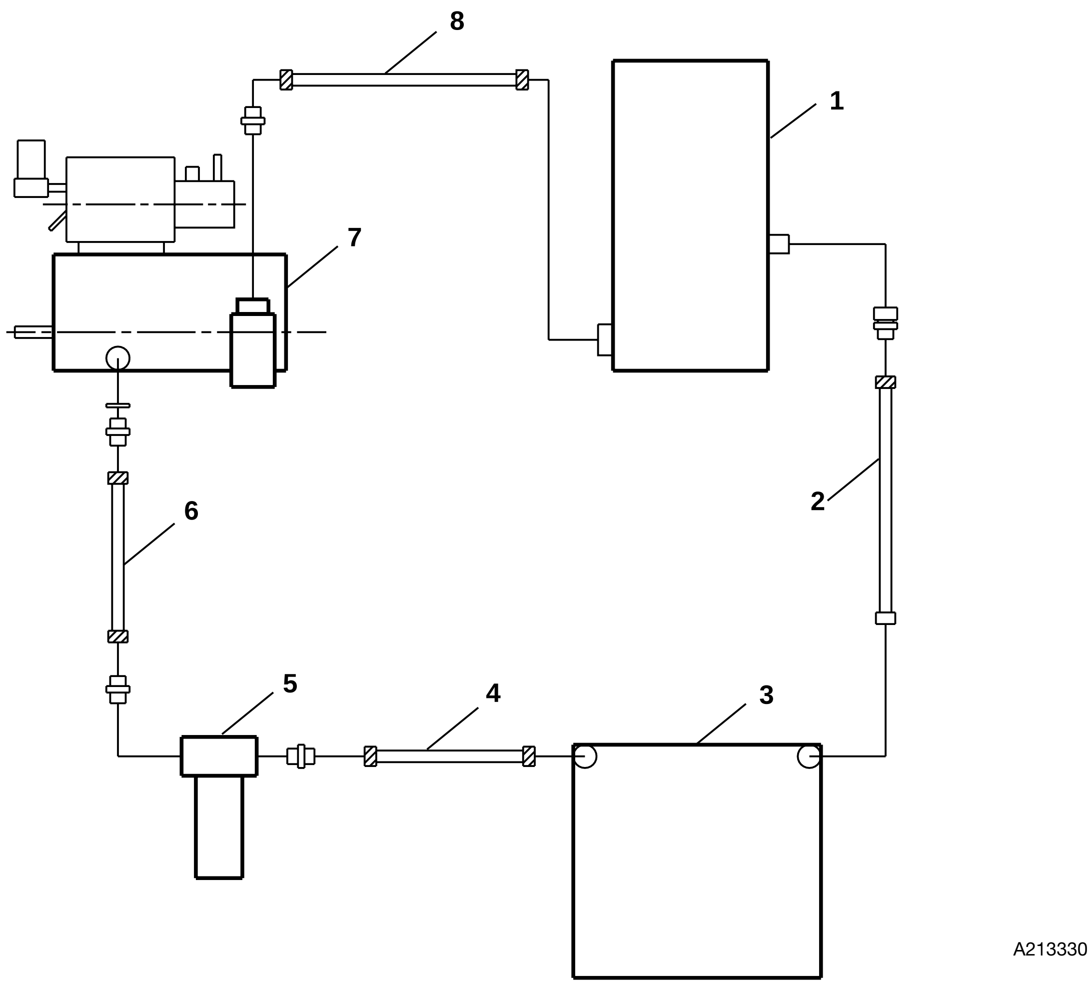
Cooling System

Heat is continuously extracted from the air being compressed by the injection of a controlled flow of cool oil into the compressor unit rotor casing. This contributes to efficient compression and results in acceptably low air delivery temperatures without the need for other intercoolers or aftercoolers.

After separation from the discharged air, the oil is taken from the receiver and cooled in an air blast cooler **3** situated at the rear of the plant. The oil enters the top of the cooler then passes through the cooler before passing to the filter and rotors.

The air flow necessary for the cooler is provided by a pusher fan. The plant must be run with the exterior panels closed to obtain the most efficient cooling. Always select the coolest place possible for the plant to operate in; refer to **Technical Data** for maximum permissible operating ambient temperatures.

Note: Use hydraulic sealant (part number 4102/0300) for sealing fittings and threads below 3/4 in. BSP.



Descriptions (cont'd)

Oil Separation and Recovery

The air/oil receiver separates the oil from the air/oil mixture after compression has taken place and acts as an oil reservoir.

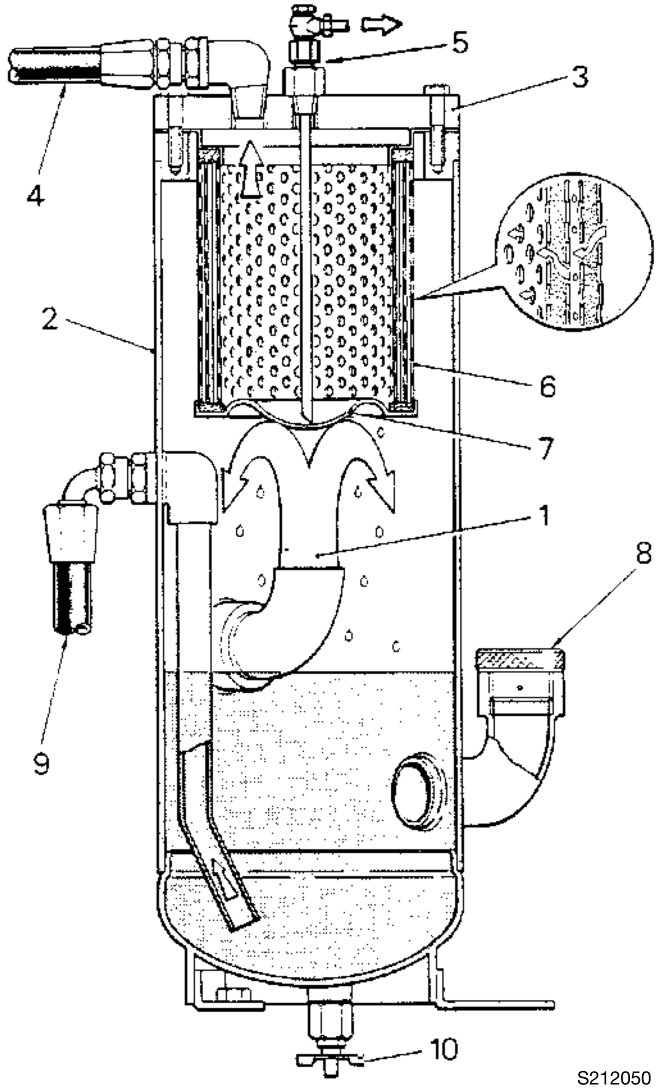
The receiver consists of a vertical steel casing **2** constructed in accordance with the appropriate standards for fusion welded pressure vessels and contains a separator **6**.

Access to the separator is provided by cover **3**. Fitted in the cover is a temperature sensor, air pressure gauge feed, oil scavenge tube **5** and air delivery pipe **4** terminating at the delivery manifold. Receiver fittings include an oil filler plug/dipstick **8**, drain tap **10** and safety valve (not shown).

The air/oil mixture **1** from the compressor enters the receiver through an angled connection which directs the mixture against the bottom of well **7**. The resulting sudden change in speed and direction of the flow causes most of the oil to drop out under gravity to the bottom of the casing where it re-joins the main oil flow and is re-circulated.

The air which now holds only a small amount of fine oil mist then flows through the separator **6** where the mist is agglomerated into large droplets which collect in well **7**.

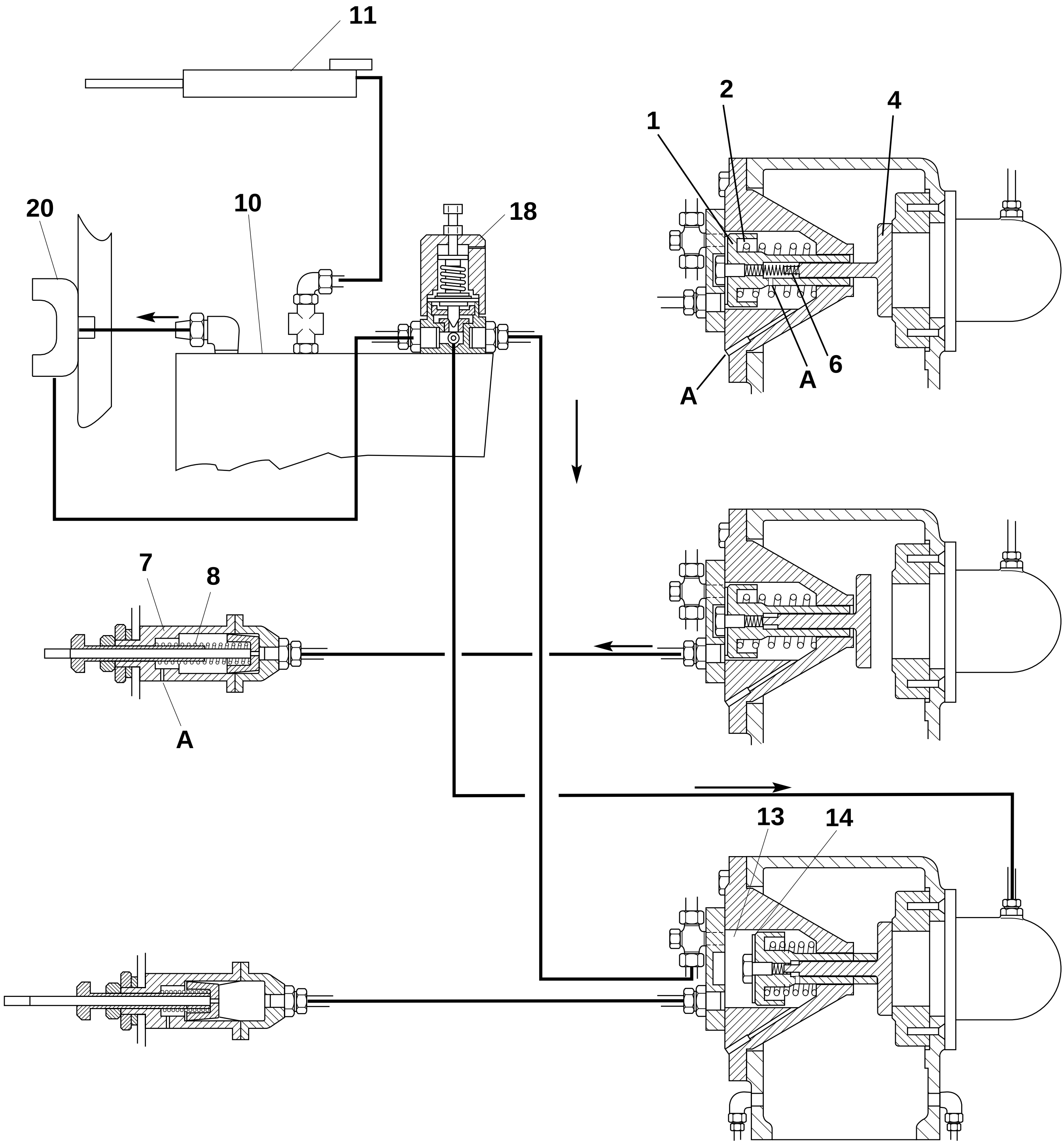
From there the collected oil is returned via the oil scavenge tube **5** to the compressor by differential pressure.



S212050

Component Key

Item	Description
1	Air/oil mixture (from compressor)
2	Receiver casing
3	Cover
4	Air delivery pipe
5	Oil scavenge tube and restrictor
6	Separator element
7	Well
8	Oil filler/dipstick plug
9	Oil feed to cooler
10	Drain tap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A213020

Descriptions (cont'd)

Unloading and Speed Control System

The compressor air output is controlled by the unloader valve **4** which regulates the amount of air admitted to the compressor unit, in conjunction with variation of engine speed via control cylinder **7**.

When the compressor is started, the vacuum created within the unloader body causes valve **4** to move against spring **6** into the bore of piston **1**. Air is thus admitted to the compressor to build up pressure in the air/oil receiver **10** and delivery manifold **20**. Receiver pressure is piped to pneumatic cylinder **11** (which increases the engine idling speed), and manifold pressure to pressure regulator **18**.

On starting up, receiver pressure passes through the pneumatic cylinder and acts directly on unloader diaphragm **14** and speed control cylinder. When the receiver pressure reaches approximately 7.0 bar (100 lbf/in^2), it overcomes springs **2** and **8**. Piston and unloader valve then move to the right to close off the air intake, and the speed control cylinder reduces the engine speed to idling.

As the demand for air from the machine varies, regulator **18** will adjust the pressure in diaphragm chamber **13** in response, and the unloader valve and speed control cylinder will move until the air demand is exactly matched.

When the compressor is shut down correctly (i.e. the delivery cocks are first closed) the machine will be off-load with the unloader valve held firmly on its seat. As the rotors stop turning, pressure in the receiver is prevented from getting back to the inlet pipework by the closed unloader valve which now acts as a non-return valve.

The resulting pressure build up within the unloader body is utilised to operate the blowdown valve to release all pressure within the machine to atmosphere.

As the pressure in diaphragm chamber **13** dissipates, spring **2** moves piston **1** to the left, while the unloader valve extends from the piston bore to remain on its seat, assisted by spring **6**.

The system is then ready for the next start-up.

Note that vents **A** are used to dissipate residual pressure that may otherwise prevent the respective pistons from moving.

Descriptions (cont'd)

Blow Down Valve

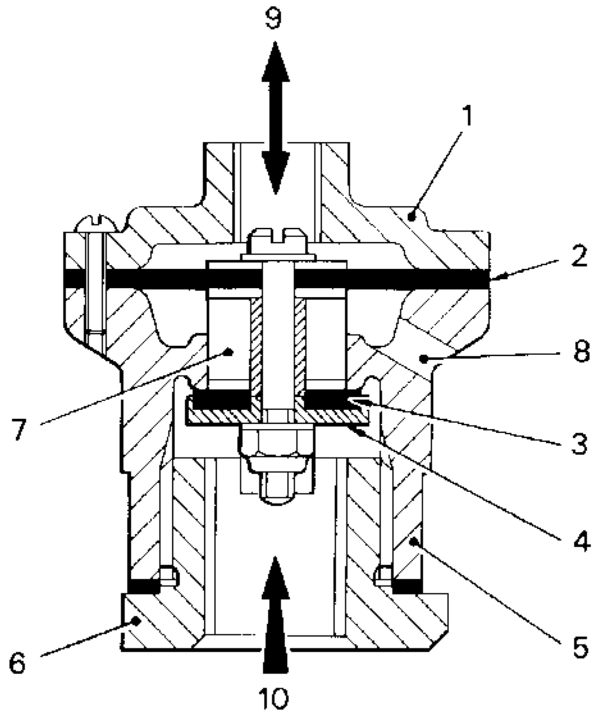
The blow down valve is situated on top of the receiver. It operates automatically to release all air pressure within the system on shut-down, thus ensuring that the plant is not started against delivery pressure.

The valve consists of a body **5** which contains a fluted valve guide **7**, valve **4** and valve seating washer **3**. The valve components are attached to a diaphragm, and the whole is enclosed by a cap **1** at one end and a screwed cover **6** at the other.

When the plant is running, a depression is created within the unloader body which is applied to the top of the diaphragm **2** via inlet **9**. Receiver air pressure **10** acts simultaneously against the underside of the valve **4** and washer **3**. The washer is therefore retained firmly on its seat thus preventing the escape of receiver pressure through ports **8** in the upper portion of the valve body.

On shut-down the delivery cocks are first closed, then the engine is stopped. The residual pressure in the receiver builds up within the unloader body (the unloader valve now acting as a non-return valve as described on page **A/15 - 4** and is applied to the top of diaphragm **2**.

This pressure on the large area of diaphragm **2** is sufficient to overcome the receiver pressure acting on the smaller area of valve **4**, therefore the washer **3** is lifted from its seat so allowing the pressure still in the receiver to escape to atmosphere through ports **8**.



S211980

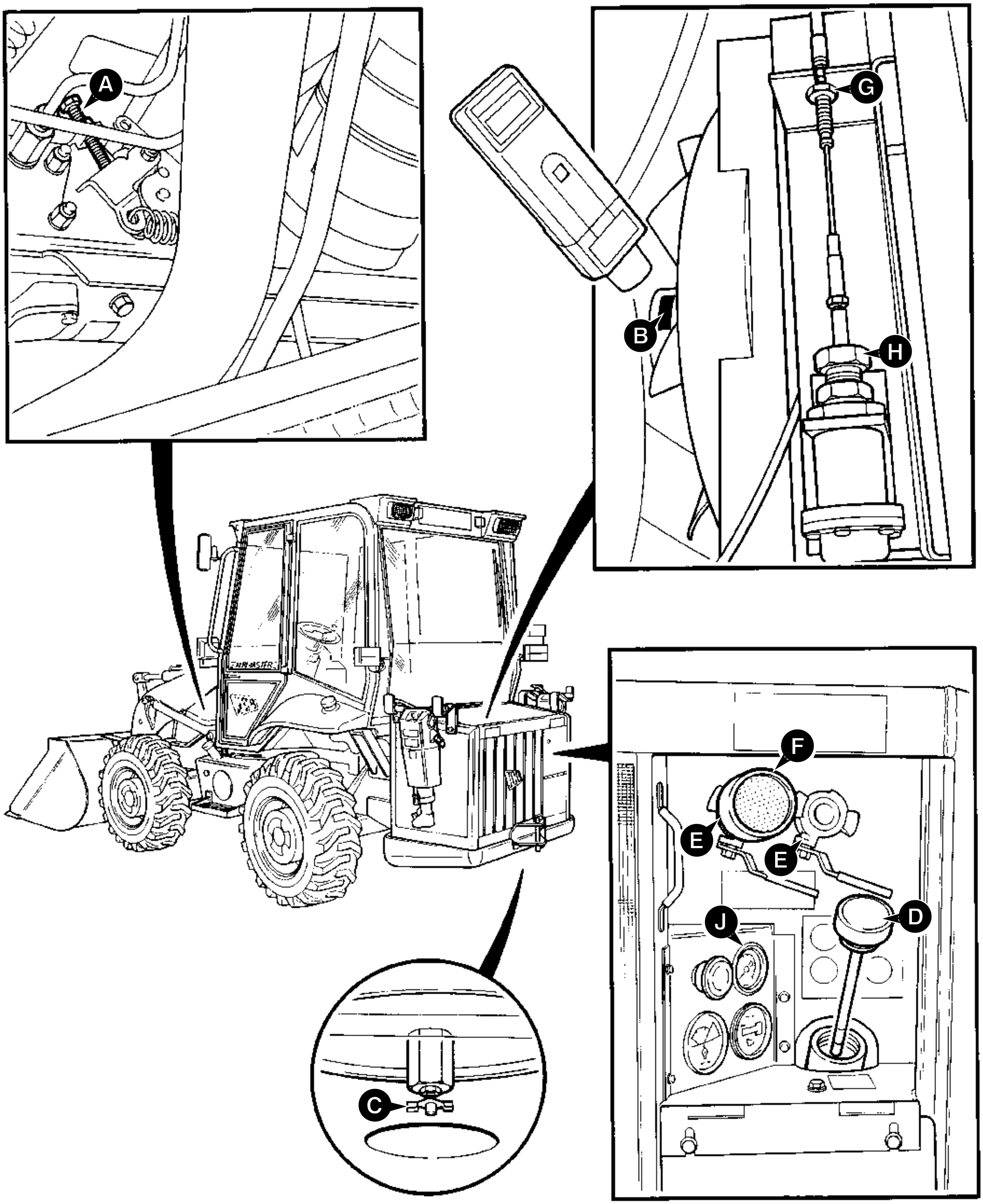
Descriptions (cont'd)

Transmission

The Airmaster compressor is driven by a propshaft connected to a P.T.O. on the syncro shuttle gearbox. For descriptions and procedures relating to the P.T.O. and propshaft systems and components see **Section F, Transmission**.

Fault Finding

FAULT	POSSIBLE CAUSE	REMEDY
Compressor fails to build up to working pressure	a Choked air intake filter	a Change air intake filter element
	b Suction unloader valve stuck on seat	b Inspect and release valve through unloader air intake
	c Faulty blow down valve	c Overhaul or change blow down valve
	d Faulty gauge	d Overhaul or change gauge
Compressor fails to off-load (safety valve blowing)	a Suction unloader valve stuck open	a Inspect and release valve through unloader air intake
	b Suction unloader/compressor joint leak	b Tighten or renew joint
	c Punctured diaphragm on pressure regulator or unloader piston	c Inspect and renew
	d Safety valve faulty	d Inspect and rectify
	e Air/oil separator faulty	e Clean or change element
Plant not operating at correct minimum or maximum speed	a Speed control faulty	a Reset speed control
	b Engine fault	b Refer to engine Service Manual
Excessive compressor oil consumption	a Receiver scavenge oil restrictor choked	a Clean oil restrictor
	b Air/oil separator faulty	b Clean or change element
	c Incorrect grade of oil	c Drain and refill with correct grade of oil
Shut down due to high air delivery temperature	a Machine not standing level or sited badly	a Level machine or resite for maximum air flow
	b Air receiver level low	b Top up air receiver oil
	c Incorrect grade of compressor oil	c Drain and refill with correct grade of oil
	d Air/oil separator choked	d Clean or change element
	e External surface of oil cooler clogged	e Clean external surface of oil cooler
	f Clogging of compressor oil circulating system	f Drain, flush and refill oil circulating system
	g Faulty temperature switch or circuit	g Check circuit and/or change faulty switch(es)
Compressor drive will not engage	a Parking brake not applied, transmission not in neutral	a Engage parking brake, put transmission in neutral
	b Power take-off solenoid fuse (A6) blown	b Change fuse
	c Power take-off solenoid faulty	c Check circuit and change solenoid if necessary



S254300

Commissioning the Compressor

If for any reason the compressor settings are disturbed, for example if the throttle cable is replaced, or after major servicing, the compressor should be set correctly using the following procedure:

1 Start the engine and allow to warm for approximately 3 minutes.

2 Make sure that the idle speed of the engine is between 850 - 900 r.p.m., if necessary adjust the idler stop **A** located on the fuel injection pump.

3 Stop the engine and fit a reflective strip to the fan mounting on the compressor, shown at **B** (this will be used to measure the compressor speed - steps **12** and **14**).

4 Make sure that the parkbrake is fully engaged.

5 Check that the air receiver drain plug **C** is fully closed.

6 Remove the air receiver fill/level plug **D**, if required add oil to the maximum mark. Use only recommended oil.

Note: Make sure that the fill/level plug O-ring is in good condition and correctly installed in the groove. If the O-ring is not installed correctly, the plug could unscrew whilst the machine is running.

7 Make sure that the air delivery cocks **E** are closed.

8 Start the engine.

9 Engage the compressor, the engine revs will rise and then lower when pressure is built up. Be aware that the compressor fan will be running.

10 Fit the exhaust silencer **F** (part number 892/00877) to one of the air delivery cocks.

⚠ WARNING

Do not stand directly in front of the air cock. Pressurised air will be released from the exhaust silencer when the air cock is open. Compressed air can cause injury to you or others.
ATT 2-1

11 Fully open the air cock that is fitted with the silencer.

⚠ WARNING

Keep clear of rotating parts. The compressor cooling fan will be rotating. Rotating parts can cause injury.
ATT 2-2

12 Measure the compressor speed (use a suitable strobe light tachometer aimed at the reflective strip), the speed should be between 2120 - 2140 r.p.m. If required, adjustment can be made on the outer cable. Lock up the nuts **G** when the revs are set.

13 Close the air cock.

14 Measure the compressor idle speed (use a suitable strobe light tachometer aimed at the reflective strip), the speed should be between 1550 - 1570 r.p.m. If required, adjust the governor. Lock the nuts **H** when the idle speed is set.

15 Check the pressure gauge **J** located on the compressor control panel. Maximum working pressure is 6.9 bar (100 lbf/in^2). If necessary adjust as described on page **A/31-1**.

16 Make sure the air delivery cocks are closed and check the foot pedal operation - if adjustment is required, adjust on the pedal stop.

The machine/compressor is now commissioned. DO NOT attempt to remove the exhaust silencer from the air delivery cock until the silencer has cooled down.

Air/Oil Separator

Removal and Replacement

Providing the compressor oil has been changed at the prescribed intervals and is free from contamination, the separator should require only infrequent attention. If, however, the oil consumption of the compressor rises or oil mist is discharged with the delivered air, then it may be necessary to change the air/oil separator.

IT IS RECOMMENDED THAT THE SEPARATOR IS CHANGED BUT IF CIRCUMSTANCES NECESSITATE, IT MAY BE CLEANED AND REFITTED.

1 Disconnect the scavenge oil pipe, the air pressure gauge, the air delivery hose and the electrical connections to the receiver air temperature switch.

2 Remove the six set screws **A** securing the receiver cover **B**. Lift off the cover and top gasket.

3 Examine the receiver scavenge oil restrictor **C** (this is a 1.6mm ($^1/_{16}$ in) smooth bore hole in receiver cover). Clean it if necessary.

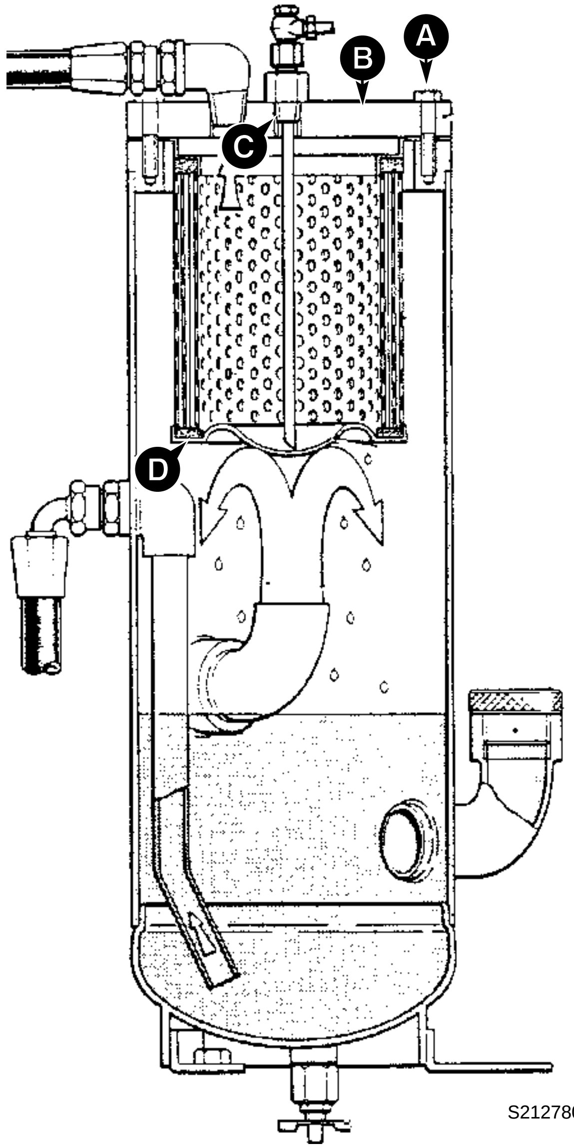
4 Slacken and remove the static earthing screw passing through the separator and bottom gasket **D**, and withdraw the separator.

5 Renew the separator. No other servicing is permitted.

6 The separator should be assembled in the reverse order to dismantling and new gaskets fitted. Torque tighten the receiver cover screws to 68 Nm (50 lbf /ft).

⚠ CAUTION

Ensure the static earthing screw is replaced correctly.



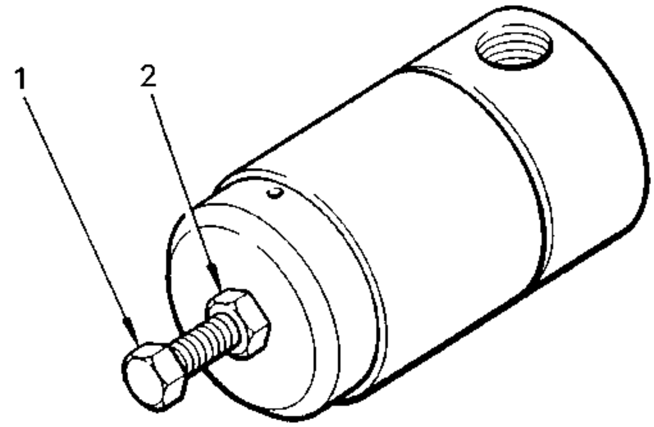
S212780

Pressure Regulator

Off-load Air Pressure Regulation

The pressure control system fitted to these machines operates over a range of approximately 1 bar (15 lbf/in^2), so that the off-load air pressure (unloader valve shut, engine idling) is approximately 1 bar higher than the full-load pressure (unloader valve wide open, engine at maximum speed).

The normal off-load air pressure is 6.9 bar (100 lbf /in^2), and machines leaving the factory are set at this figure.



S212030

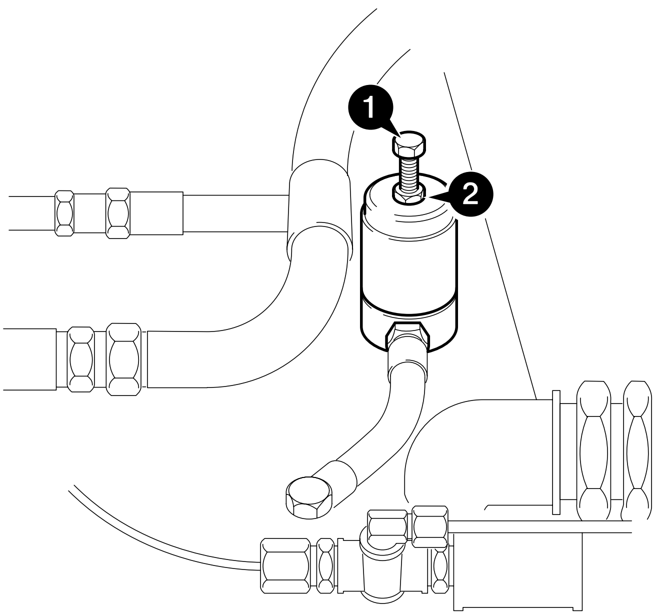
Checking Safety Valve Setting

The pressure regulator is used to check the setting of the safety valve **A** (refer also to page **A/5-10**).

With the plant running and the air delivery cocks closed, release the locknut **2** and turn the pressure regulator adjusting screw **1** clockwise to raise the off-load air pressure. **BEWARE OF ESCAPING AIR/OIL MIXTURE.**

The safety valve should operate at 7.7 to 8.2bar (113 to 120lb/in^2).

Reset the off-load air pressure to 6.9bar (100lb/in^2) on completion.



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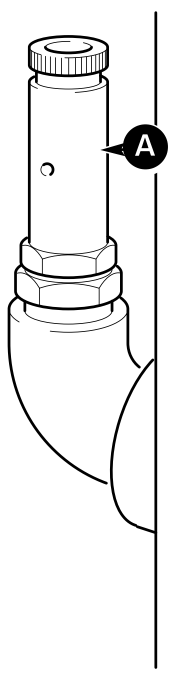


A391180

Suction Unloader

Dismantling

1 Unscrew the six screws **11** and remove the diaphragm body assembly **10** from the unloader body **4**. Withdraw the valve and spring **7** from the piston **8**.

2 Secure the diaphragm body in a vice with the end cover **15** uppermost. Remove the four bolts **16** and then the end cover. Withdraw the piston/diaphragm assembly and spring **6.**

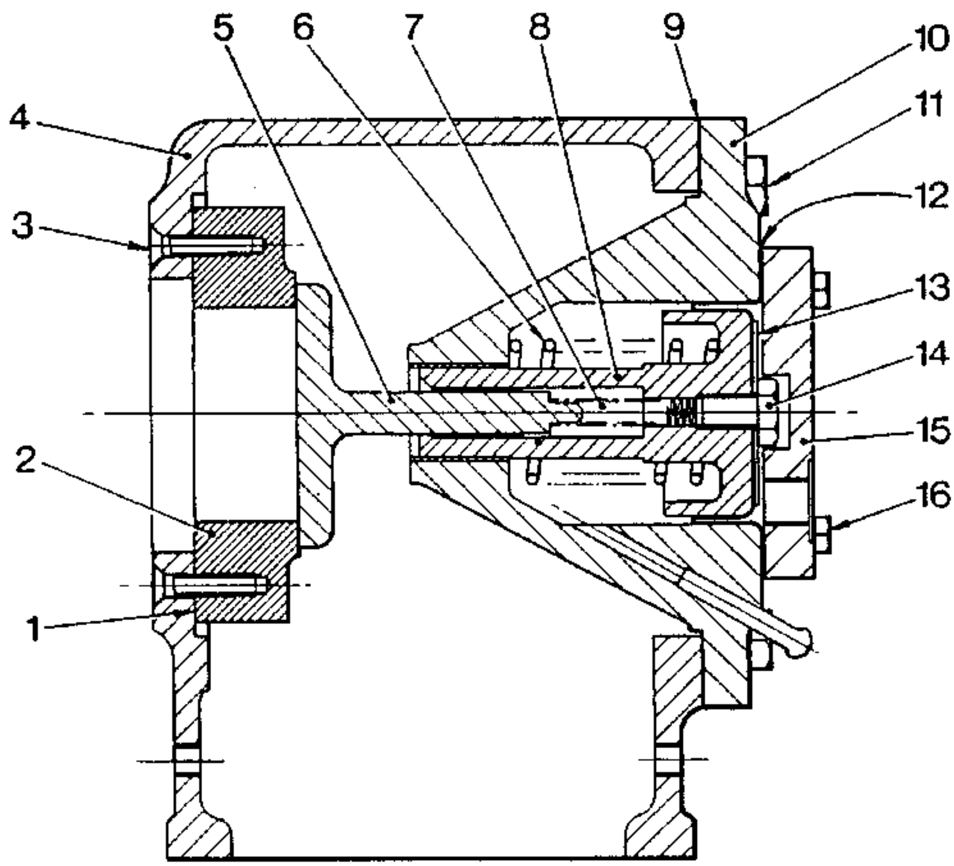
3 Remove the diaphragm body from the vice, then position the piston in the vice with the diaphragm uppermost.

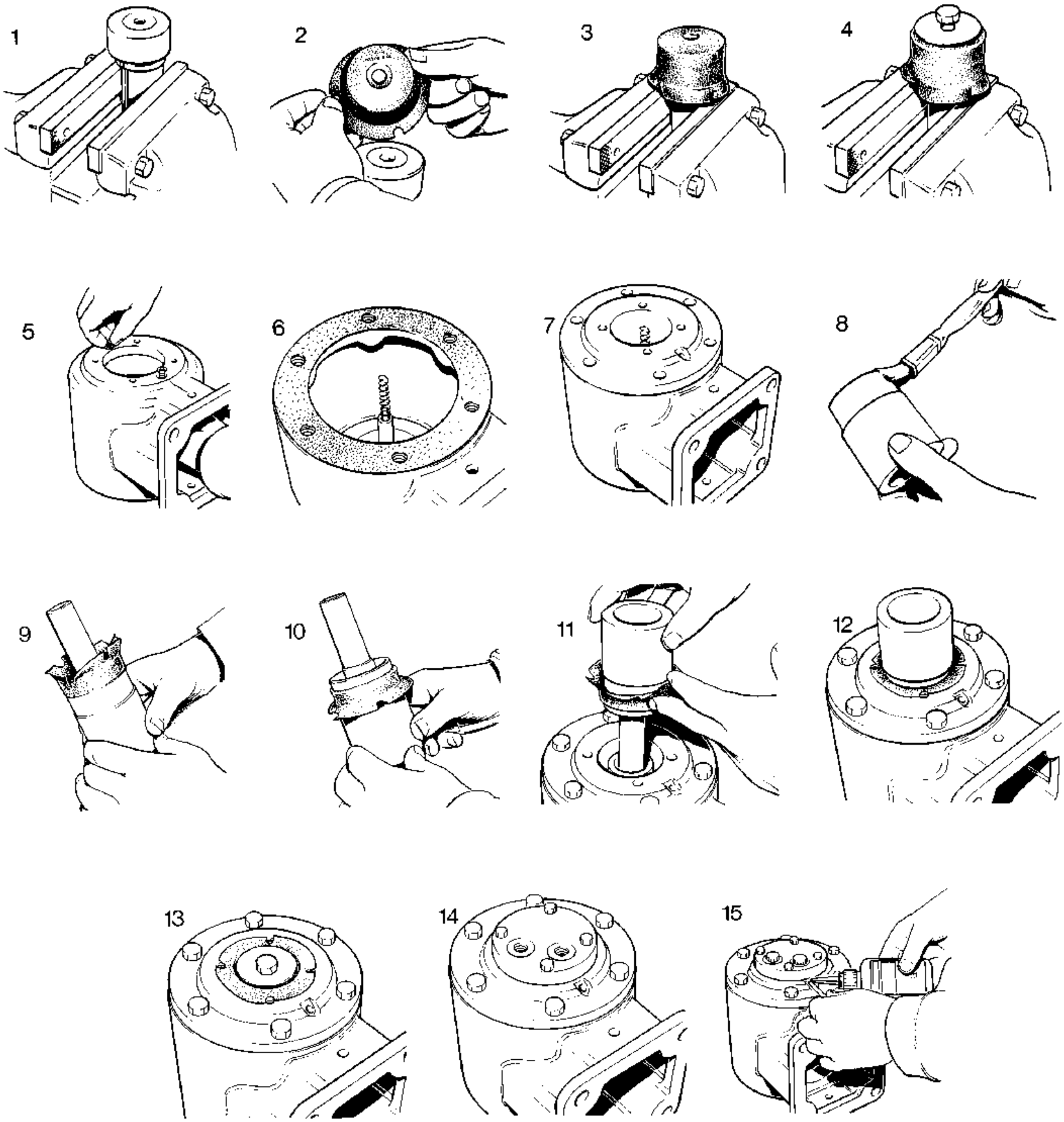
⚠ CAUTION

Ensure the machined diameters of the piston are not damaged. Hold in a split bushing for convenience.

4 Remove bolt **14**, plate **13** and diaphragm **12**.

5 Unscrew the countersunk screws **3** and remove the valve seat **2** and joint **1**.

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Suction Unloader

Assembling

1 Secure piston in a vice, large diameter uppermost with the piston held in a split bushing for convenience. Assemble the diaphragm, retaining plate and bolt, using JCB Lock & Seal (part number 4101/0202) on the threads (views **1- 4**).

Note: When fitting a new diaphragm, it is essential to first turn it inside out. The fabric (dull) side is marked PISTON SIDE and must be in contact with the piston, smooth side in contact with the retaining plate.

2 The outside diameter of the retaining plate has a radius on one edge. The plate must be assembled with this radius edge in contact with the diaphragm to avoid damage to the latter.

3 Remove the piston/diaphragm assembly from the vice. Into the unloader body fit joint and valve seat, securing with countersunk screws **5**.

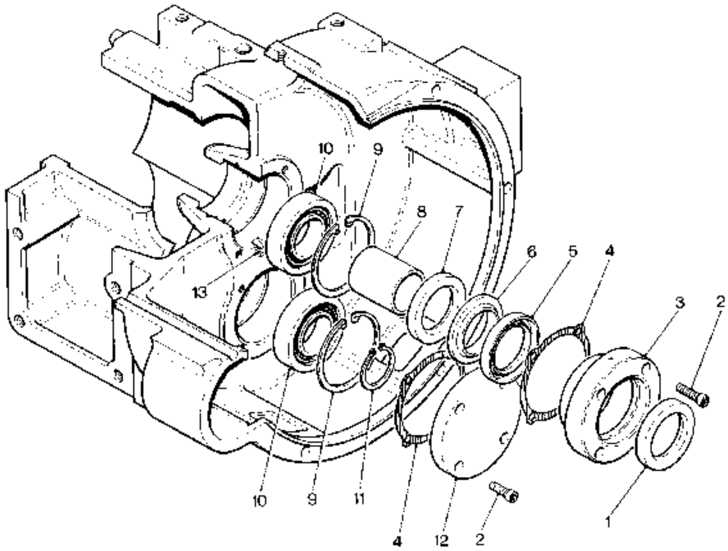
4 Turn the unloader body upside down and place valve and spring into position on the valve seat. Place joint into position **6**.

5 Carefully lower the diaphragm body into position, ensuring that the atmospheric vent is in the correct position. Secure the body with its six screws **7**.

6 Lubricate special tool (part number 892/00878) inside and out and insert the piston/diaphragm assembly. Smooth the diaphragm back along the outside of the tool. Replace spring then carefully insert the piston/diaphragm assembly into the body. Align the diaphragm with the holes in the body. Note that these holes are off-set to ensure correct positioning of the end cover. Carefully remove the special tool (views **8-13**).

7 Replace the end cover and secure with its four bolts. If assembling a new atmospheric vent pipe, use JCB High Strength Retainer (part number 4101/0602) to fix in position (views **14-15**).

Fig. 2 INLET BEARING ASSEMBLY



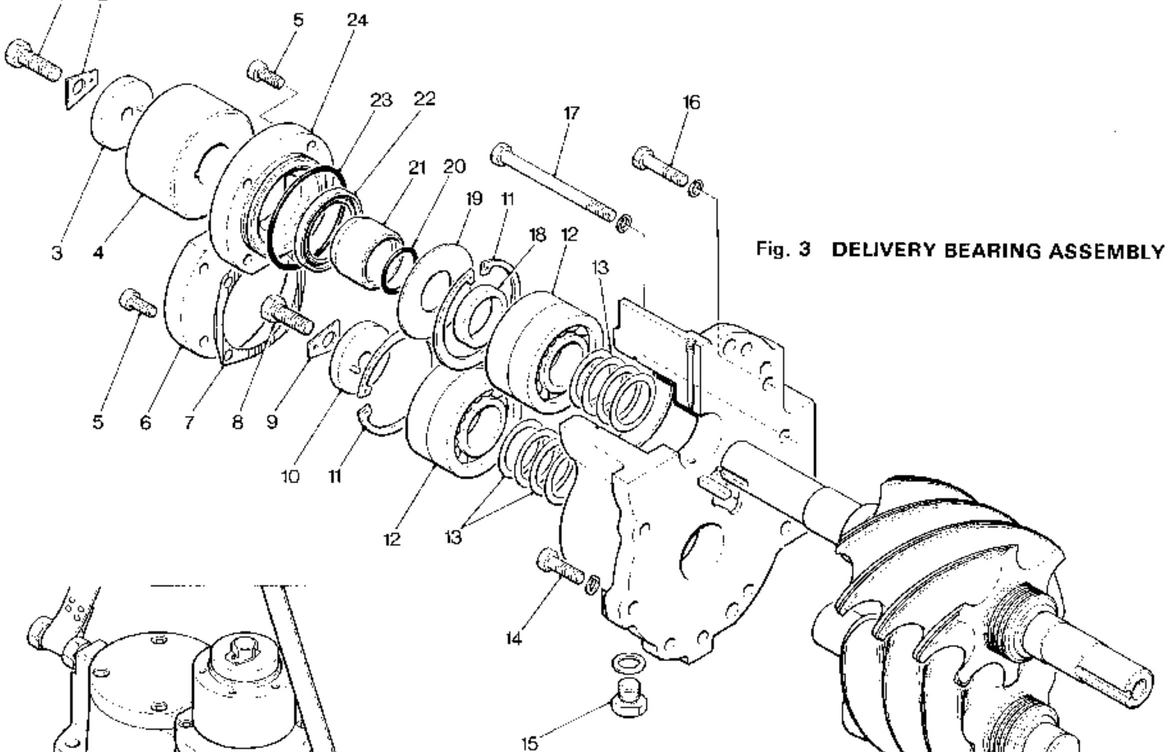


Fig. 3 DELIVERY BEARING ASSEMBLY

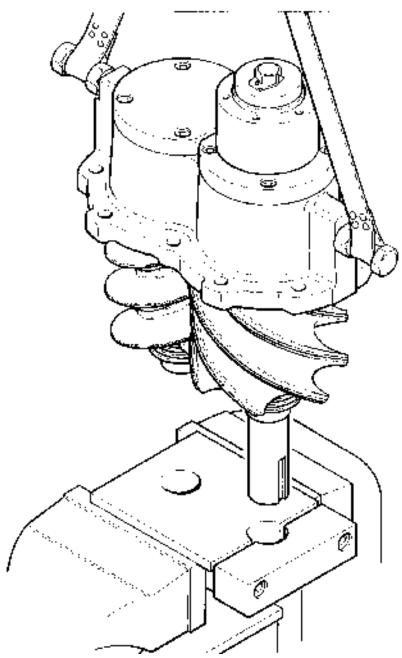


Fig. 4
LOWERING DELIVERY END CASING/ROTOR ASSEMBLY INTO FIXTURE

S212000

Compressor Unit

Dismantling and Assembly

When Dismantling

Note: Prior to dismantling the compressor unit, an area should be cleared and cleaned so that each part can be laid out in assembly order for inspection. Every precaution should be taken to keep out dirt from oil passages or exposed apertures. During the dismantling and assembly of the unit certain operations will require the use of special equipment to prevent damage to parts. Contact JCB Special Products for information on these special tools. The tools are referred to throughout the text by their item numbers, see '**Service Tools**' to identify the tool and item number.

It is assumed that the compressor has been removed from the machine with coupling removed so that access is available to the input shaft.

1 Working inside the bell-housing, unscrew 8 x M6 capscrews (Fig. 2 (2)) and remove the oil seal housing (3) and bearing cover (12).

2 Remove the single outer seal (1), then drift out the two inner seals (5, 7) and back-up washer (6) using service tool (tool 19). Always use a new back-up washer with new spiroseal lip seals.

3 Stand the unit on the engine mounting face. Take care not to damage its locating spigot. Remove the 1/4" BSP plug (Fig. 3 (15)) from the delivery end casing. Fit sling pin L.H. (tool 14) and its washer into the vacated hole, and sling pin R.H. (tool 11) into the M10 x 1.5 - 6H hole on the opposite side of the casing.

4 Unscrew the 10 x M10 bolts (14, 16, 17) securing the delivery end casing to the inlet/rotor casing. Using two suitable levers, separate the delivery end casing/rotor assembly from the inlet/rotor casing. Attach suitable lifting gear and lift the rotor assembly clear, taking care not to damage the tip seals along the periphery of the rotors.

5 Secure fixture (tool 6) in a vice and lower the rotor assembly into the fixture with the female shaft in the clamping hole (Fig. 4). Clamp the shaft securely. Remove the sling pins.

6 Check the delivery end clearance between the ends of the rotors and the delivery end casing with a feeler gauge. This is important as any excess clearance will result in a loss of efficiency owing to air under pressure finding its way back to the inlet/rotor casing. The checking of clearances at this stage will, if they are correct, prevent unnecessary work during re-assembly.

7 Release the lock-plate (Fig. 3 (2)) and remove the retaining screw (1) and plate (3) from the fan spigot (4). Remove the fan spigot.

8 Unscrew the eight capscrews (5) and remove the bearing end caps (6, 24). Withdraw the spigot spacer (21), oil thrower (19) and thrower spacer (18) from the female rotor shaft. Extract the taper circlip (11) from the bearing bore.

9 Release the locking plate (9) and remove the retaining screw (8) and plate (10) from the male rotor shaft. Extract the taper circlip (11) from the bearing bore.

10 Attach fixture (tool 1) with spacers and bolts to the delivery end casing (Fig. 5). Fit long stud (plain end to rotor shaft) in hole over male shaft and short stud over female shaft. With nuts locked on their threaded ends, alternately screw down the studs and draw the delivery end casing and bearings clear of the rotors.

11 With the fixture still attached to the delivery end casing, screw down the long stud so that its thread protrudes sufficiently to attach extractor (tool 9), washer and two nuts locked together. Screw the stud back up through the plate until the bearing is pulled clear of the casing. Repeat for the second bearing.

12 Remove circlips (Fig. 2 (9)) from the inlet bearing bores and, using drift (tool 17), drive out the bearings.

13 Remove the coupling spacer (8) and inner bearings track from the female rotor shaft using service tool (tool 12). Repeat for male shaft inner bearing track after removing its circlip (11).

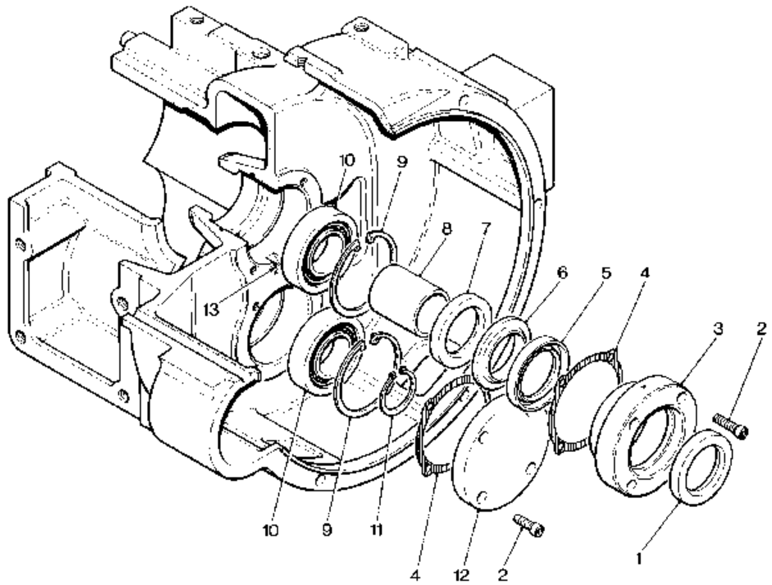


Fig. 2 INLET BEARING ASSEMBLY

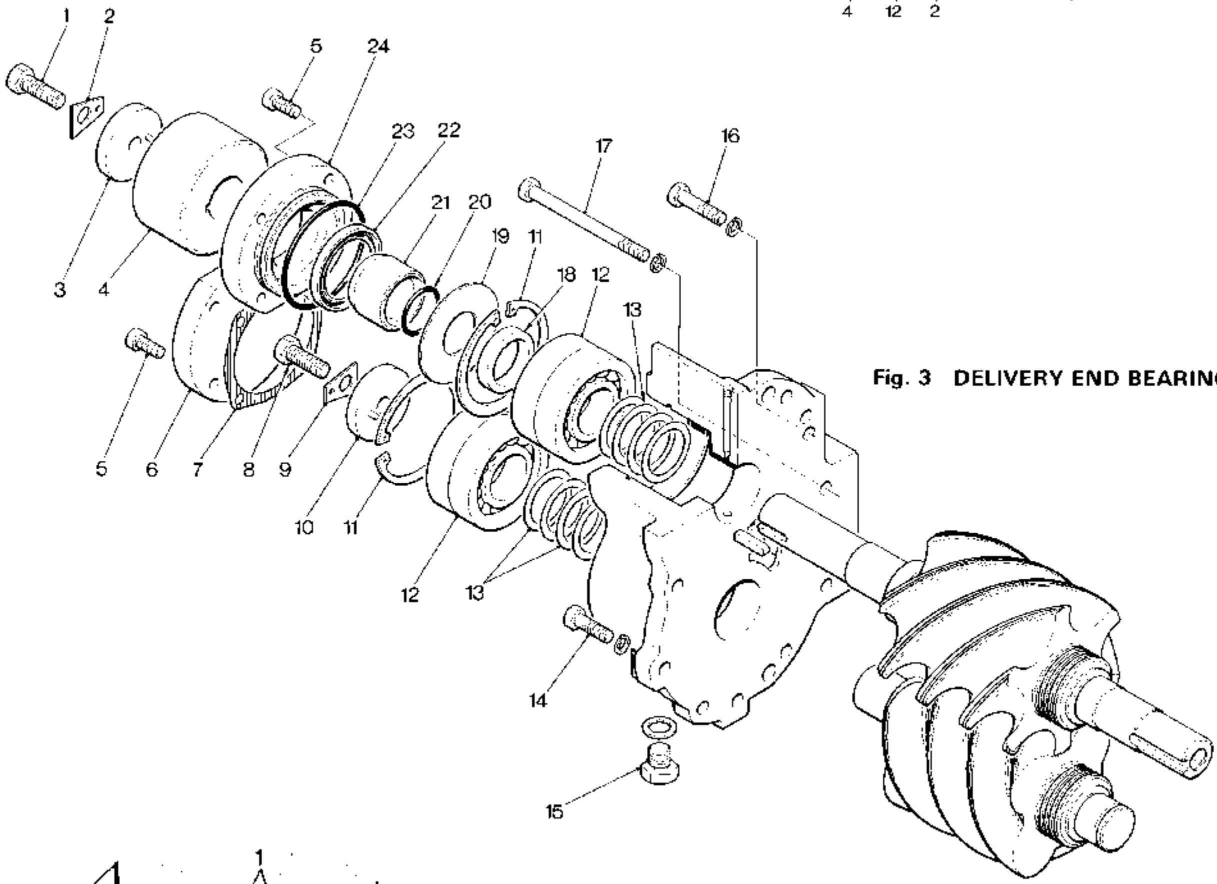


Fig. 3 DELIVERY END BEARING

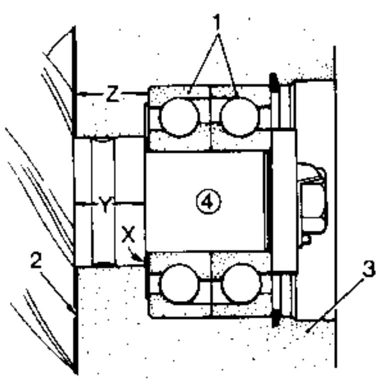


Fig. 6 DELIVERY END CLEARANCE

S211990

Compressor Unit (cont'd)

Dismantling and Assembly

When Assembling

Note: Before assembling the compressor ensure that all parts are serviceable and thoroughly clean, and that all oil passages in the casings are clear. Use new locking plates for screws, new joints for sealing faces and new ‘O’ rings. When fitting new bearings use only specified type.

1 When renewing the inlet end bearings it is important that each inner track be assembled with its respective bearing. With the inlet/rotor casing lying on the delivery end face, drift the bearings (Fig. 2 (10)) into position using service tool (tool 17) and replace the two circlips (9).

2 Check the bearings and place the appropriate inner tracks in a container of oil and raise the temperature to 100°C (212°F). Place a heated inner track on its appropriate shaft and drift it hard against the shoulder using service tool (tool 1). Repeat for the other shaft. Assemble circlip (11) on to the male rotor shaft.

3 If it has been necessary to repair or renew the rotors or the delivery end casing, the new delivery end clearance must now be established (Fig. 6 (2)). To do this, measure the dimension ‘Y’ on the rotor (4) and dimension ‘Z’ on the delivery end casing (3). Dimension ‘Y’ must be 0.05 to 0.10 mm (0.002 to 0.004 inch) greater than dimension ‘Z’ for correct delivery end clearance. In isolated cases this will not be so and therefore shims must be added to the bearing journal at ‘X’ to increase dimension ‘Y’. The checking of dimensions ‘Y’ and ‘Z’ must be carried out on each rotor and their respective bores in the delivery end casing.

4 Secure fixture (tool 6) in a vice and place the rotors in position with the female shaft in the clamping hole and **tighten the clamp securely**. This is important as damage to grooved seal diameter may occur if the rotor turns during later torquing up of the delivery end bearing screws.

5 Place the delivery end casing in position over the rotor shafts and place the selected shims on their respective shafts. Position the first matched pair of bearings “face to face” (Fig. 6 (1)) over the female shaft and, using service tool (tool 8) long stud, nut and washer, pull the bearings into the delivery end casing and onto the shaft. Remove the tool and fit the second pair of bearings similarly to the male shaft. Assemble the taper circlips (Fig. 3 (11)) ensuring that the bearings are located against the bottom of their bores. The tapered face of the circlips should face outwards.

6 Lubricate the bearings. Assemble the spacer (18) and oil thrower (19) onto the female rotor shaft. Lightly oil the ‘O’ ring (20) and position the spacer - fan spigot (21) similarly, taking care not to damage the ‘O’ ring on the keyway.

7 Assemble the fan spigot onto the female shaft followed by the retaining plate, and screw. Torque the screw to 100 Nm (74 lbf/ft).

8 Fit the retaining plate, locking plate and screw to the male shaft and similarly torque the screw to 100 Nm (74 lbf/ft).

9 Check for correct delivery end clearance between the ends of the rotors and the delivery end casing (Fig. 6 (2)) with a feeler gauge. Check in at least four positions on each rotor. The correct clearance is 0.05/0.10 mm (0.002/0.004 inch). If it is incorrect, remove the offending rotor/s (see para 10, 'dismantling') and re-select shims.

10 With the correct clearance established, remove the screw, retaining plate and fan spigot from the female shaft. Using service tool (tool 16), drift a new seal (Fig. 3 (22)) into the delivery bearing end cap (24). Lightly oil the sealing lip and, using a new ‘O’ ring, fit the end cap over the rotor shaft and into the casing bore. Coat its four capscrews with JCB Lock & Seal and secure the end cap with the screws torqued to 27 Nm (20 lbf/ft).

11 Assemble the fan spigot with key onto the female shaft followed by the retaining plate, locking plate and screw. Torque the screw to 100 Nm (74 lbf/ft).

12 Oil the rotors, release the rotor locking clamp and check for free rotation. Re-clamp the female shaft and lift the locking plate tabs on the female and male bearing retaining screws.

13 Using a new joint, and JCB Lock & Seal on the capscrews, refit the male bearing end cap, torquing the capscrews to 27 Nm (20 lbf/ft).

14 Fit the sling pins in the delivery end casing. Stand the inlet/rotor casing on its engine mounting face, taking care not to damage the locating spigot. Remove the rotor assembly from the clamp and, using a new joint, carefully lower the rotors into the casing (female rotor on centre-line of engine mounting flange). Locate the delivery end casing on the dowels. Remove the sling pins and secure with the 7 off - M10 x 35, 1 off - M10 x 40 and 2 off - M10 x 110 bolts torqued to 54 Nm (40 lbf/ft).

Compressor Unit (cont'd)

Dismantling and Assembly

When Assembling

15 Turn the inlet/rotor casing onto its side. Working inside the bell housing clean the female shaft and coupling spacer (Fig. 2 (8)) with JCB Super Clean Solvent. Use JCB Lock & Seal to make a seal between shaft and spacer by applying a complete run around the shaft about 20 mm from the bearing. Assemble the spacer and rotate a full circle to ensure a complete seal of sealant. Place the clamp (tool 10) on the shaft with M12 x 45 screw and torque to 100 Nm (74 lbf/ft).

16 Assemble oil seals (1 & 5) into the oil seal housing (3) using service tool (tool 15). Pack between the seals with JCB HP Grease. Fit back-up washer (6). Finally fit oil seal (7) using service tool (tool 16). Lightly oil the O/D of the coupling spacer and clamp. Using a new joint, slide the oil seal housing into the inlet/rotor casing.

Note: The capscrew holes in housing and joint are off-set to ensure correct positioning of the relief relative to oil port (13).

Secure with 4 (long) M6 capscrews coated with JCB Lock & Seal and torque to 11 Nm (8 lbf/ft). Remove the clamp.

17 Using a new joint, refit the bearing cover over the male inlet bearing. These capscrew holes are off-set also. Use JCB Lock & Seal and replace the four capscrews, torque tighten to 11 Nm (8 lbf/ft).

18 Check all plugs and fittings are replaced. Refit the delivery mounting foot, inlet adaptor and unloader. Replace the compressor unit in the machine.

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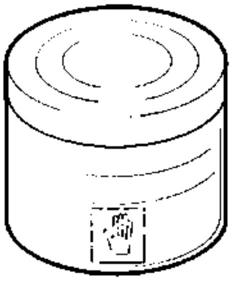


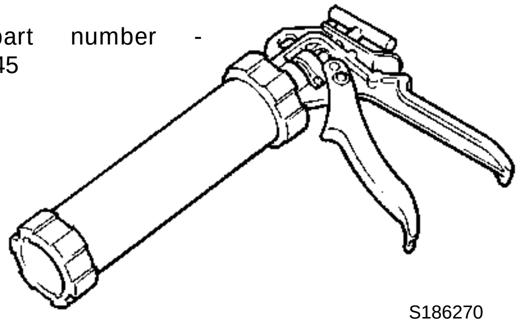
Hand Cleaner - special blend for the removal of polyurethane adhesives.

JCB part number - 4104/1310
(454g; 1 lb tub)

S186240

Cartridge Gun - hand operated - essential for the application of sealants, polyurethane materials etc.

JCB part number - 892/00845



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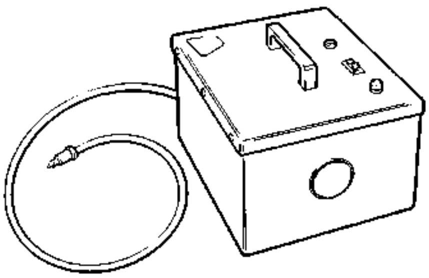
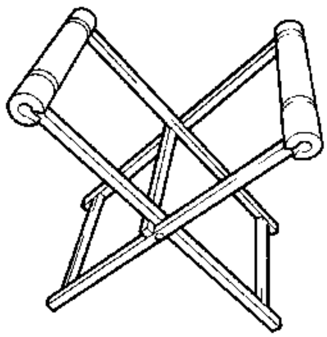


12V Mobile Oven - 1 cartridge capacity - required to pre-heat adhesive prior to use. It is fitted with a male plug (703/23201) which fits into a female socket (715/04300).

JCB part number - 992/12300

S186250



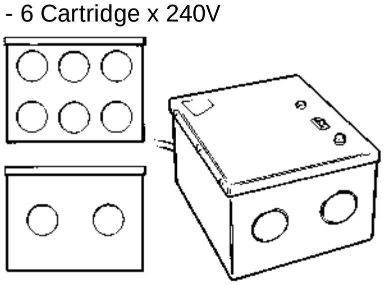
Folding Stand for Holding Glass - essential for preparing new glass prior to installation.

JCB part number - 892/00843

S186280

240V Static Oven - available with 2 or 6 cartridge capacity - required to pre-heat adhesive prior to use. No plug supplied. Note: 110V models available upon request - contact JCB Technical Service.

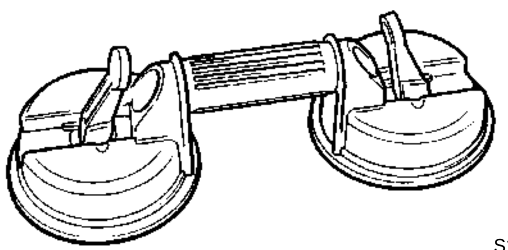
JCB part number:
992/12400 - 2 Cartridge x 240V
992/12600 - 6 Cartridge x 240V



S186260

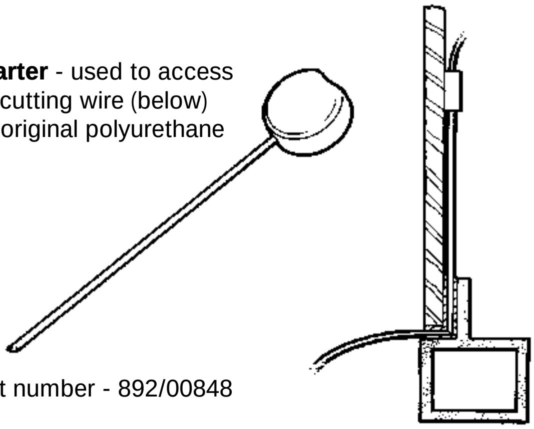
Glass Lifter - minimum 2 off - essential for glass installation, 2 required to handle large panes of glass. Ensure suction cups are protected from damage during storage.

JCB part number - 892/00842



S186300

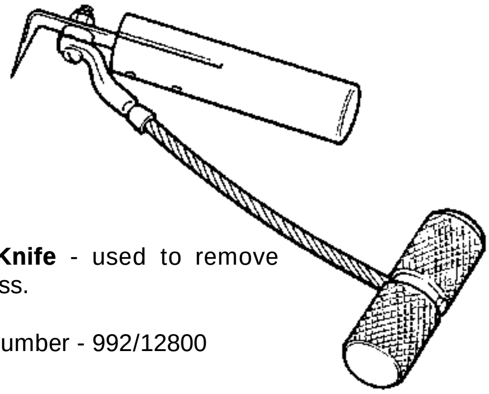
Wire Starter - used to access braided cutting wire (below) through original polyurethane seal.



JCB part number - 892/00848

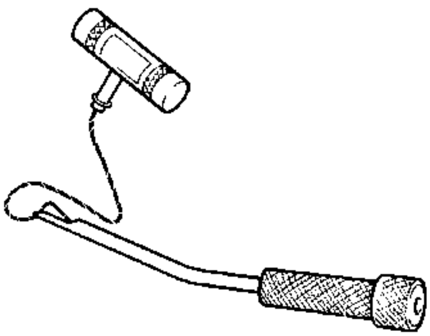
S186310

Cut-Out Knife - used to remove broken glass.



JCB part number - 992/12800

S186340



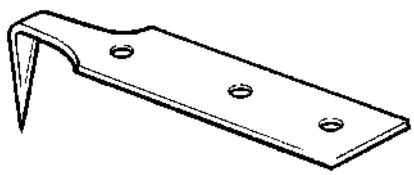
Glass Extractor (Handles) - used with braided cutting wire (below) to cut out broken glass.

JCB part number - 892/00846

S186320

'L' Blades - 25 mm (1 in) cut - replacement blades for cut-out knife (above).

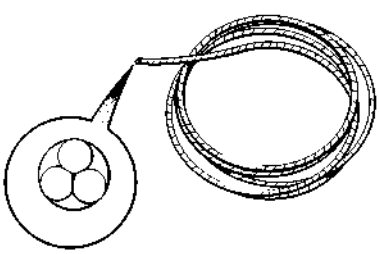
JCB part number - 992/12801 (unit quantity = 5 off)



S186350

Braided Cutting Wire - consumable heavy duty cut-out wire used with the glass extraction tool (above).

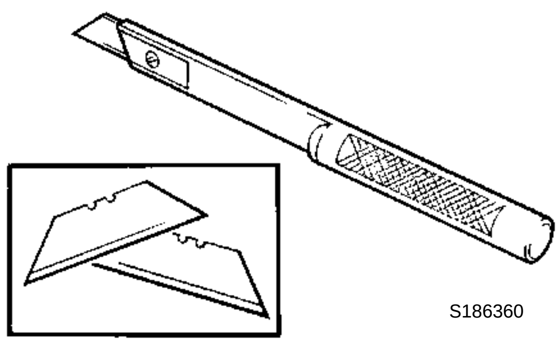
JCB part number - 892/00849
(approx 25 m length)



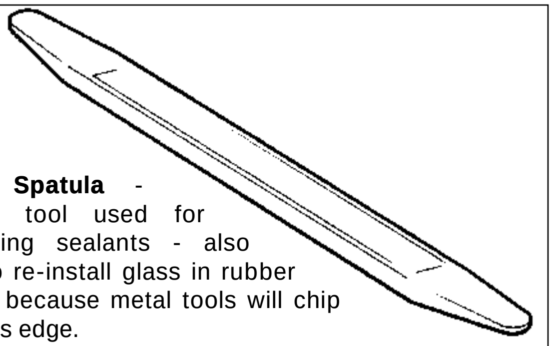
S186330

Long Knife - used to give extended reach for normally inaccessible areas.

JCB part number - 892/00844



S186360



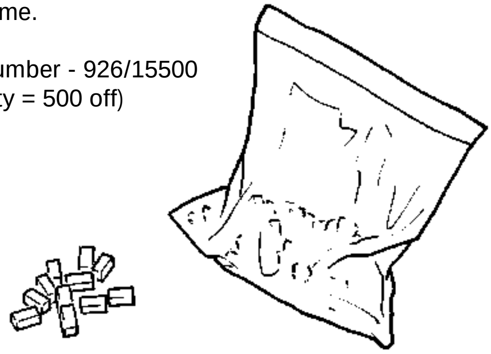
Nylon Spatula - general tool used for smoothing sealants - also used to re-install glass in rubber glazing because metal tools will chip the glass edge.

JCB part number - 892/00847

S186470

Rubber Spacer Blocks - used to provide the correct set clearance between glass edge and cab frame.

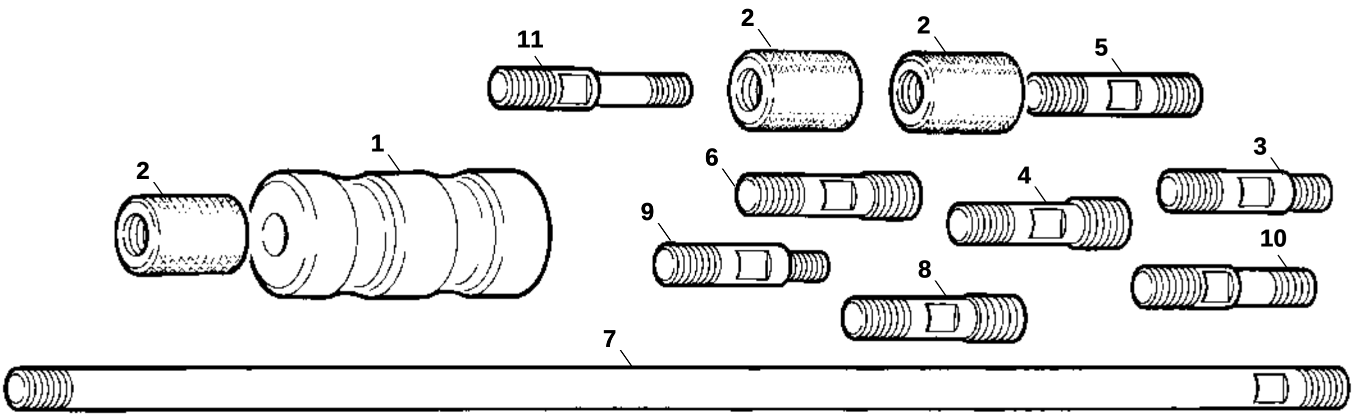
JCB part number - 926/15500
(unit quantity = 500 off)



S186550

Slide Hammer Kit - 993/68100

1	:993/68101	Slide Hammer
2	:993/68102	End Stops
3	:993/68103	Adaptor - M20 x 5/8" UNF
4	:993/68104	Adaptor - M20 x 1" UNF
5	:993/68105	Adaptor - M20 x M20
6	:993/68106	Adaptor - M20 x M24
7	:993/68107	Bar - M20 x M20 X 800MM
8	:993/68108	Adaptor - M20 x 7/8" UNF
9	:993/68109	Adaptor - M20 x M12
10	:993/68110	Adaptor - M20 x 5/8" UNF (Shoulder)
11	:993/68111	Adaptor - M20 x 1/2" UNF



S196910

Air Conditioning

R-134a Refrigerant

Due to environmental concerns, the use of ozone depleting chlorofluorocarbons (CFCs) in air conditioning systems is being gradually phased out.

The R-12 refrigerant used in some systems contains CFCs and is now being replaced by a hydrofluorocarbon (HFC) refrigerant R-134a, which does not cause ozone depletion. **The refrigerant used in the 2CX air conditioning system is R-134a.**

Air conditioning systems using R-134a refrigerant are not compatible with systems using R-12 refrigerant. No attempt should be made to charge R-134a systems with R-12 refrigerant.

System Operation

To maintain optimum operator comfort in warm climates or during seasons of high ambient temperature, the air conditioning system delivers cool, dehumidified air into the cab. Cooling is provided by passing the warm ambient air, together with recirculated air, over an evaporator coil in the air conditioning unit.

The air conditioning system is a closed circuit through which the refrigerant is circulated, its state changing from gas to liquid and back to gas again, as it is forced through the system.

The major components of the system are the compressor **A**, condenser **B**, receiver drier **C**, expansion valve **D** and evaporator coil **E.**

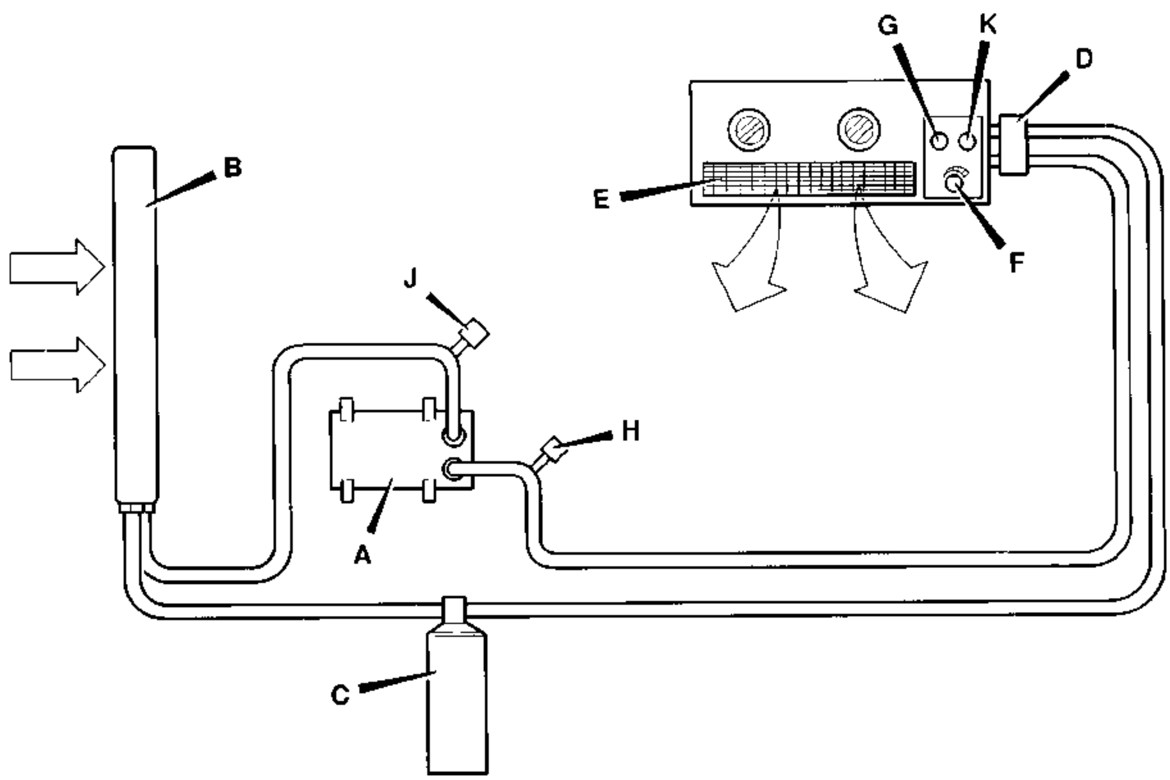
To operate the air conditioning, the operator turns the air conditioning switch **F** clockwise to the ON position and turns the blower switch **G** clockwise to select a suitable blower running speed for the ambient conditions.

Note: Switch **K** controls the amount of coolant supplied to a heater coil in the air conditioning unit. This control enables air conditioned air to be heated to supply warm, de-humidified air to the cab in cool, humid climates.

Provided that the ambient temperature is above 0°C and the blower switch is away from the OFF position, the air conditioning will switch on. The compressor's electromagnetic clutch operates, engaging the compressor drive from the engine pulley system. The compressor **A** draws in low pressure refrigerant gas from the suction line (evaporator to compressor) and increases refrigerant pressure through compression. Increasing pressure also increases refrigerant temperature.

High pressure refrigerant is forced from the compressor to the condenser **B**, mounted in front of the engine radiator. Ambient air is drawn across the condenser fins by the engine cooling fan. In the condenser, the refrigerant changes state to a high pressure, high temperature liquid but with a lower heat content.

The refrigerant passes through the receiver drier **C**. The receiver drier serves as a reservoir for refrigerant and also contains a desiccant to remove moisture from the system.



193150

Air Conditioning (cont'd)

The high temperature, high pressure refrigerant is forced by compressor action into the expansion valve **D**, which meters the amount of refrigerant entering the evaporator. In the expansion valve the refrigerant instantaneously expands to become a low pressure, low temperature liquid.

The refrigerant is drawn through the evaporator coil **E** by the suction of the compressor. The temperature of refrigerant is now considerably below that of the air being drawn across the evaporator coil by the blower. Heat is transferred from the ambient and recirculated air to the refrigerant, causing the low pressure liquid to vaporise and become a low pressure gas. Moisture in the air condenses on the evaporator coil and is drained away via condensate drain tubes through the cab floor.

Cool de-humidified air is emitted through air vents into the cab.

The low temperature, low pressure, high heat content refrigerant gas, is now drawn by suction back to the compressor, where the cycle is completed.

System Control

Control of the system is achieved by the cyclic action of the compressor's electromagnetic clutch. The thermostat switch senses the evaporator coil temperature by means of a capillary tube and cycles the compressor clutch on and off to prevent freezing of condensate on the evaporator coil.

The signal from the thermostat switch is sent to the compressor clutch via two pressure switches. These are designed to disengage the compressor clutch and protect the system from damage that would be caused by either refrigerant loss or excessive pressure.

The low pressure switch **H** is connected to the suction hose adjacent to the compressor. If the pressure in the suction hose falls below the low pressure switch setting, it opens, interrupting the supply from the thermostat to disengage the compressor clutch.

The high pressure switch **J** is connected to the discharge hose adjacent to the compressor. If the pressure in the discharge hose rises above the high pressure switch setting, it opens, interrupting the supply from the thermostat to disengage the compressor clutch.

Switch Pressures

Low Pressure Switch
Cut in = 2.1-2.6 bar (30-38 lbf/ in^2)
Cut out = 0.3-0.6 bar (4-8 lbf/ in^2)

High Pressure Switch
Cut in = 15.5-19 bar (225-275 lbf/ in^2)
Cut out = 23.4-24.8 bar (340-360 lbf/ in^2)

Safety Procedures

The air conditioning system uses refrigerant under pressure in a closed circuit. Any service procedure which breaks into the closed circuit and therefore requires discharging of the system, must only be carried out by an air conditioning engineer. The following guidelines should be adhered to by all personnel servicing the air conditioning system.

⚠ WARNING

The air conditioning system is a closed loop system and contains pressurised refrigerant. No part of the system must be disconnected except by a qualified refrigeration engineer.

4-3-4-1

1 It is critical that the correct refrigerant is used and that charging is done only by qualified personnel. It is illegal to discharge the refrigerant into the atmosphere but as a precaution in case of accidental leakage, discharging and charging of the vehicle refrigerant system must be conducted in a well ventilated area.

2 Containers of refrigerant should be stored in a cool environment away from direct sunlight.

⚠ WARNING

Do not carry out welding operations close to the air conditioning refrigerant circuit. A poisonous gas is produced when refrigerant comes into contact with naked flames. Do not smoke or allow naked flames close to the refrigerant circuit.

BF 1- 9

3 **Do Not** perform welding operations close to refrigerant hoses (maintain a distance of at least 0.5m from hoses).

4 **Do Not** steam clean refrigerant system components.

5 When charging or discharging the refrigerant system, no smoking or naked flames should be allowed in the immediate vicinity. The refrigerant does not give off a poisonous odour, however, when it comes into contact with a naked flame, a poisonous gas is produced.

6 When handling refrigerant, rubber gloves and goggles should be worn. Operators should ensure no refrigerant comes into contact with the skin. Particular care should be taken when connecting or disconnecting charging hoses or pressure switches. When these components are connected to the system, a short release of refrigerant occurs. This results in a high velocity, very cold gas being emitted from the connection point.

7 When checking the state of the refrigerant at the receiver drier sight glass, it is necessary to run the engine with the LH side panel removed and the bonnet raised. Extreme care must be taken to avoid moving engine parts such as fans, pulleys and belts.

Air Conditioning

Procedures that require charging or discharging the system are not given in this manual as they require special equipment that is usually held only by trained refrigeration engineers.

The system will not function in very low ambient temperatures, therefore tests should be carried out in a warm environment.

It is recommended that, to locate faults on the system accurately and quickly, an electronic leak detector and a refrigerant pressure gauge should be used. However, leaks can be detected on the system by using soapy water applied to the suspected leak area and system pressure can be assessed by the state of refrigerant passing through the receiver drier sight glass. Following sections of the manual deal with the major components of the air conditioning systems and give further fault finding and maintenance information.

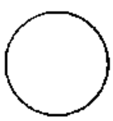
General Fault Indications

There are several indications that may help to determine the fault area on a system not working efficiently:

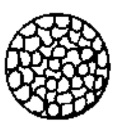
a)	Poor performance	Low system pressure - Condenser coil air flow restricted -	Evacuate and recharge system. Remove debris from around coil using compressed air or low pressure water.
b)	Warm or slightly cool air emitted from unit	Expansion valve stuck open or closed -	Renew expansion valve.
c)	Blower operates on fan speed 3 only	Blower resistor failed - Blower motor failed -	Renew resistor. Renew blower motor.
d)	Compressor clutch continually cuts out	Condenser coil blockage - Overcharging of refrigerant system- Blocked expansion valve/condenser -	Remove debris from around coil/renew condenser. Evacuate and recharge system. Clear blocked component .

Sight Glass Indications

An approximate indication of the condition of the refrigerant can be seen through the receiver/drier sight glass when the compressor is running. Refer also to **Service Procedures - Checking Refrigerant Charge Level**.



Clear - No fault indicated unless the system is unable to provide cool air. The indication then is that the system is completely discharged of refrigerant.



Foam or bubbles - Refrigerant low and in need of charging.

Clouded - Dessicant breakdown in the receiver-drier.

S201520

Note: Sight glass indications cannot always give a positive identification of a problem. Further diagnosis, preferably by a refrigeration engineer using pressure gauges, is advisable before reaching a definite conclusion.

Air Conditioning (cont'd)

No Air Conditioning

	CHECK		ACTION
1	Are the controls set correctly, i.e. air conditioning selected, thermostat switch set to coldest position and blower switched on?	YES: NO:	Check 2 Reset controls and retest.
2	Is the air conditioning (evaporator) blower working?	YES: NO:	Check 3. Check 4.
3	Is the compressor running (visual check of pulley/clutch)?	YES: NO:	Check11. Check 7.
4	Is the air conditioning fuse (B8) blown?	YES: NO:	Renew fuse and retest. Check 5.
5	Is there a 12V supply to the pressure switch harness? Refer to **Service Procedures - Pressure Switch Testing**)	YES: NO:	Check 6. Check 9.
6	Does the compressor clutch engage with both pressure switches bypassed? Refer to **Service Procedures - Pressure Switch Testing**)	YES: NO:	Check 7. Renew the compressor clutch and retest.
7	Does the compressor clutch engage with HP switch bypassed? (Refer to **Service Procedures - Pressure Switch Testing**)	YES: NO:	Renew high pressure switch and retest. Check 8.
8	Does the compressor clutch engage with LP switch bypassed? (Refer to **Service Procedures - Pressure Switch Testing**)	YES: NO:	Renew low pressure switch and retest. Charge check required by refrigeration engineer.
9	Does the clutch engage with thermostat switch bypassed?	YES: NO:	Renew thermostat switch and retest. Check all electrical connections.
10	Are blower switch and wiring OK?	YES: NO:	Renew blower motor. Renew switch or wiring.
11	Is sight glass indication OK?	YES: NO:	Check 12. Charge check required by refrigeration engineer.
12	Is condensor air flow blocked?	YES: NO:	Clean condensor and radiator. Check 13.
13	Is evaporator air flow blocked?	YES: NO:	Clean filter and, if necessary the evaporator. Call in refrigeration engineer.

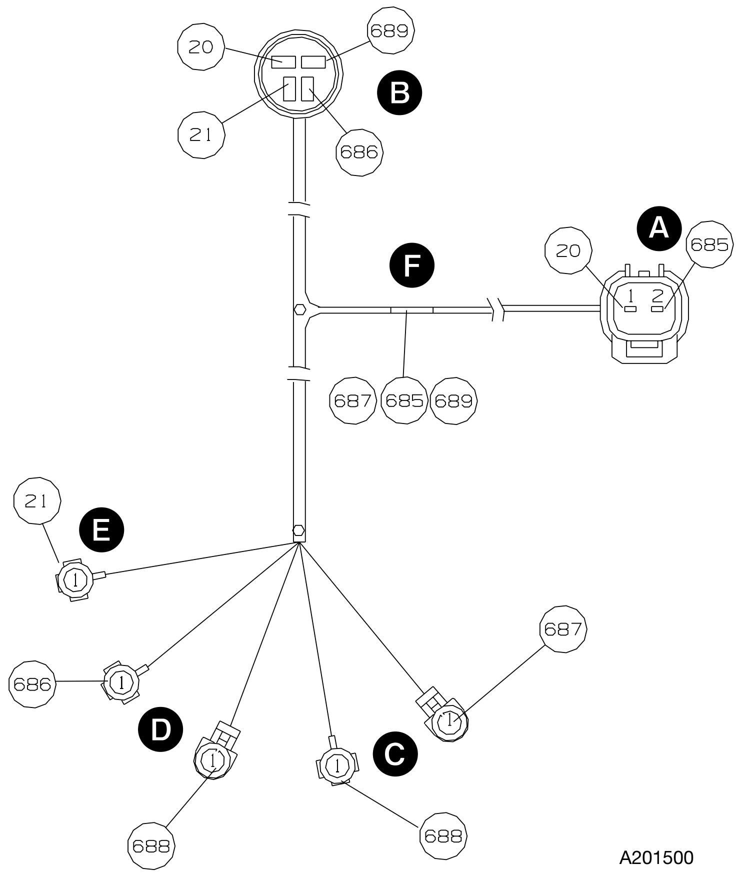
Air Conditioning (cont'd)

Wiring Continuity Checks

Use the harness illustration below to complete continuity checks on the air conditioning harness wires.The harness connects to the mainframe harness via connector **A**, located behind the side console panel.

ITEM	DESCRIPTION
A	Air Conditioning Power (from fuse C9)
B	Controls
C	Pressure Switch
D	Pressure Switch
E	Compressor
F	Splice

WIRE	DESCRIPTION
20	Controls to Power
21	Controls to Compressor
685	Power to Splice
686	Controls to Pressure Switch
687	Pressure Switch to Splice
688	Pressure Switch to Pressure Switch
689	Controls to Splice



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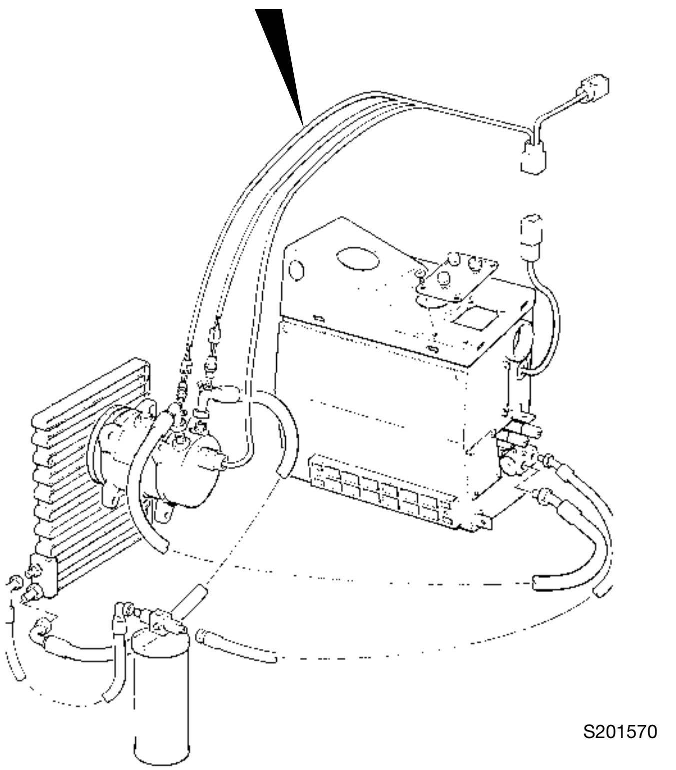

S201570

Air Conditioning

Leak Testing

Note: The refrigerant is heavier than air and will leak downwards from the defective component. Check in still conditions but in a well ventilated area.

Hose or pipe connections are likely leakage points of any refrigerant circuit.

To test for leaks in the high pressure side of the system i.e. from the compressor output to the expansion valve, run the air conditioning for a few minutes then switch off the engine and test for leakage using an electronic leak detector.

To test for leakage in the low pressure side of the system, switch off the air conditioning and leave for a few minutes before testing.

⚠ WARNING

Leak testing in Air Conditioning systems should be carried out only in a well ventilated area.

BF 1-2

Tightening Leaking Hoses

⚠ WARNING

The air conditioning system is a closed loop system and contains pressurised refrigerant. No part of the system must be disconnected except by a qualified refrigeration engineer.

4-3-4-1

The refrigerant hoses have crimped ferrule end fittings. The hose connectors have an 'O' ring seal which compresses when the connection is tight, creating an air tight seal.

Hoses are used to connect the inlets and outlets of the compressor, condenser, receiver drier and expansion valve (the evaporator coil is connected to the expansion valve within the air conditioning unit using rigid pipes).

If leakage is detected from a hose connector, either by means of an electronic leak detector or soapy water, tighten the connector up and repeat the leakage test. If leakage is still evident, it will be necessary to de-gas the system and renew the connector 'O' ring seal.

The 'O' rings used on an R-134a refrigerant system are of an HNBR compound and are colour coded green. These 'O' rings must be used as some 'O' ring materials can become porous to R-134a systems, resulting in leakage.

Checking Refrigerant Charge Level

The pressure in the system, i.e. the refrigerant charge level can be determined by checking the state of refrigerant at the receiver drier sight glass.

If the level of charge is correct the sight glass will be clear. If the charge is low bubbles will be seen. Bubbles may also be an indication of inadequate cooling, due to a restriction of air flow around the condenser coil. Recharging of the system should be carried out by an air conditioning engineer. Check refrigerant charge level as follows:

1 Park the machine on firm, level ground. Lower the backhoe and loader to the ground.

2 Remove the starter key.

3 Raise the Bonnet.

4 Remove the Left Hand Side Panel

⚠ WARNING

When the engine is turning, there are parts rotating in the engine compartment.

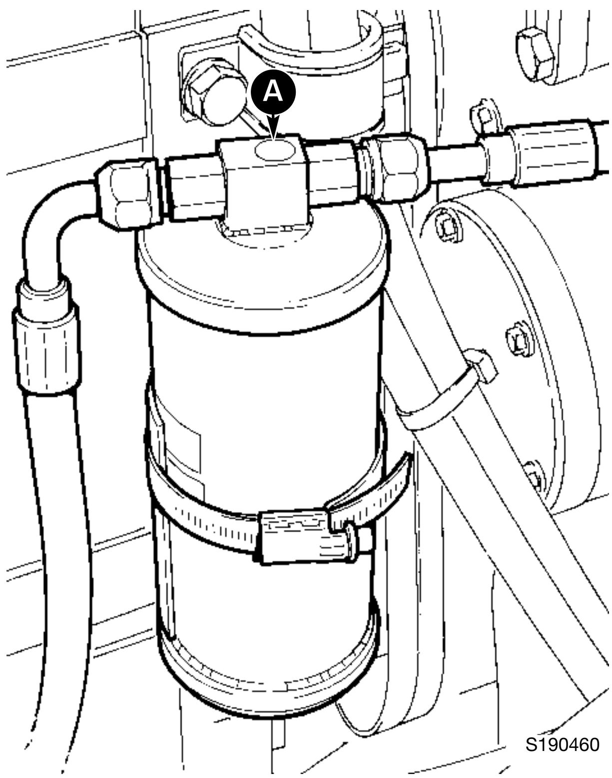
Before starting this job make sure that you have no loose clothing (cuffs, ties etc) which could get caught in rotating parts.

When the engine is turning, keep clear of rotating parts.

2-3-3-10

5 Start the engine and run at idle. Switch air conditioning ON to circulate refrigerant.

6 Check refrigerant charge level at sight glass **A**.



Air Conditioning

Pressure Switches

The 12V supply is fed from the thermostat to the compressor clutch via the low and high pressure switches which are wired in series.

The low pressure switch requires a minimum refrigerant charge level to close its contact. The high pressure switch requires the charge level to remain below the maximum limit to keep its contact closed.

Both pressure switch contacts must be closed for the compressor clutch to operate. If the compressor clutch will not operate when air conditioning is selected, the fault may be either electrical or system pressure.

Pressure Switch Testing

1 Switch the engine off so that the air conditioning system cannot operate.

2 Disconnect the pressure switch harness from the main vehicle harness and connect an external 12V power supply to the pressure switch harness connector. If both pressure switches are working correctly, and the system is at the correct charge level, the compressor clutch will operate.

   If the compressor clutch does not operate with the external power supply, one of the pressure switches is faulty or the level of refrigerant charge is insufficient to close the low pressure switch.

High Pressure Switch Testing

1 Disconnect the air conditioning harness male/female connectors from the high pressure switch **1**.

2 Connect an external 12V power supply to the harness connector - wire 688. If the compressor clutch operates, renew the high pressure switch.

   If the clutch does not operate check the low pressure switch.

Low Pressure Switch Testing

1 If the refrigerant charge level in the system is correct, but the clutch will still not function, disconnect the air conditioning harness male/female connectors from the low pressure switch **2**.

2 Connect an external 12V power supply to the harness connector - wire 686. If the compressor clutch operates, renew the low pressure switch.

Note: If both pressure switches operate correctly, check all electrical connections and the compressor clutch relay.

Removal and Replacement

⚠ WARNING

Goggles and rubber gloves must be worn when pressure switches are removed or fitted. A small amount of refrigerant is released which can be harmful to the skin and eyes.
BF 1-10

Removal

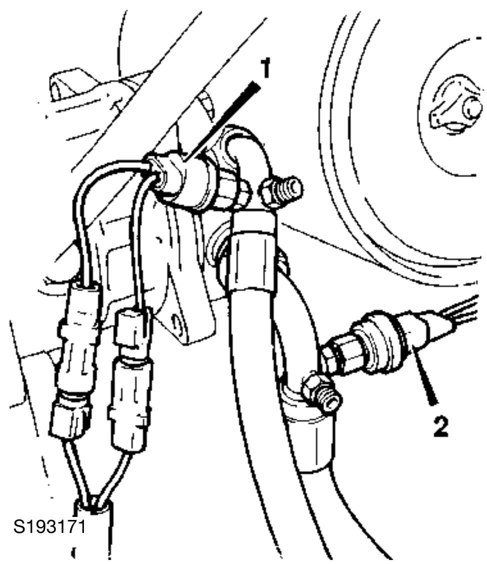
1 Disconnect the electrical connections and unscrew the pressure switch.

Replacement

Note: The high pressure switch has a red body, the low pressure switch has a bronze body, both have 1/4 UNF female threads.

1 Screw the pressure switch into the pressure switch port and torque tighten sufficiently to form a gas-tight seal.

2 Run the air conditioning and check the pressure switches for leaks. If any leaks are found, tighten the pressure switch further until the leaking stops.



Air Conditioning

Condenser Coil

It is likely that over a period of time, because of the machine's working environment, the airflow around the condenser coil will become restricted due to a build up of airborne particles.

If the build up of particles is severe, heat dissipation from the refrigerant to the air will be significantly reduced, resulting in poor air conditioning performance.

In extreme cases, over pressurisation of the system occurs, causing the high pressure cut out switch to operate and switch off the system.

High pressure cut out can also be caused by an internal blockage of the condenser coil.

Condenser Coil Cleaning

Take care not to damage the condenser fins or tubes. Damaged fins must be straightened out to ensure a good airflow through the coil.

1 Park the machine on firm level ground. Raise and block the loader arms. Lower the backhoe to the ground and stop the engine.

2 Remove the starter key.

3 Remove the front grille.

4 Remove both side panels.

5 Support the condenser **1**.

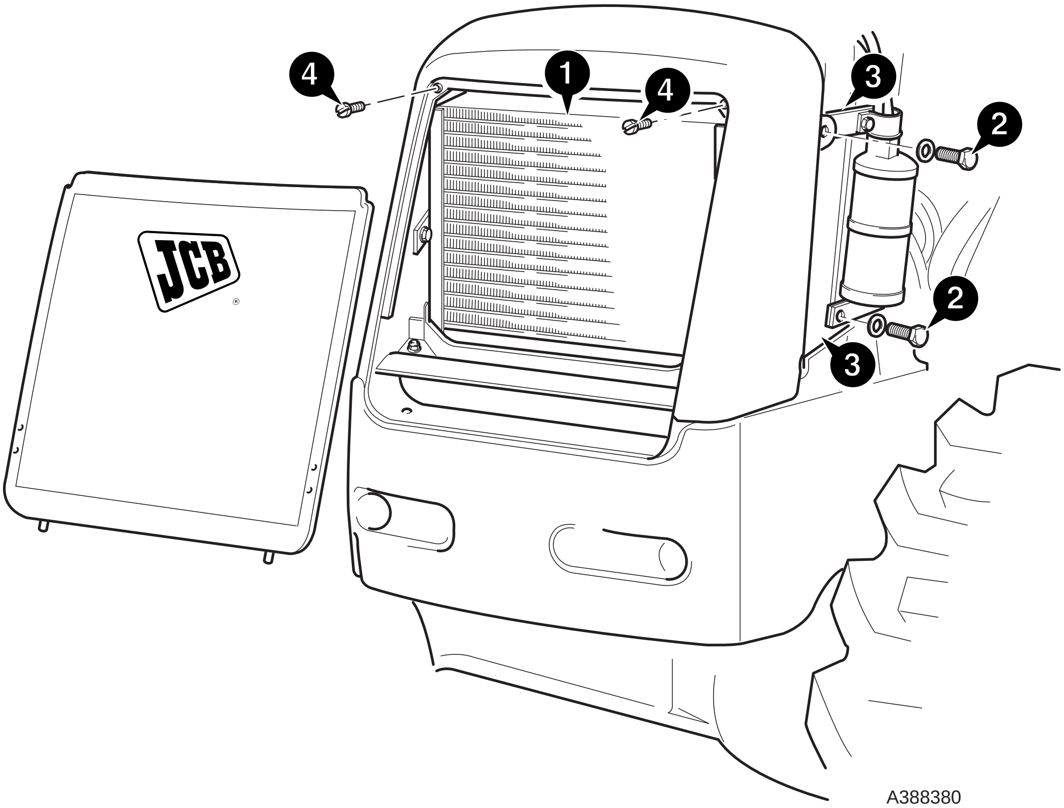
6 Undo the nuts and bolts **2** at the three mounting brackets **3**.

7 Remove the screws **4** fixing the condenser to the mounting brackets. Remove the brackets **3** to enable the condenser to be moved away from the radiator. This can be done without removing the hoses i.e. with the system fully charged.

8 With the condenser fully supported, use compressed air or low pressure water to backflow through the coil fins. Take care not to damage the fins.

9 Refit the condenser coil by reversing the removal procedure. Refit both side panels and bonnet.

10 Run the air conditioning and check cooling performance.



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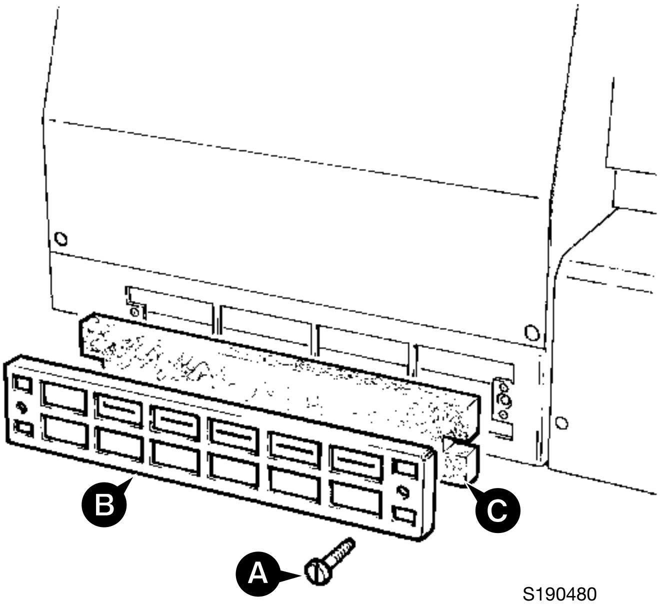
Air Conditioning

Filters - Changing and Cleaning

Recirculation Filter - Change/Clean

1 Remove screws **A**, filter cover **B** and filter **C**. Insert a new filter into the cover and refit.

Note: The recirculation filter may be washed and re-used if in good condition.



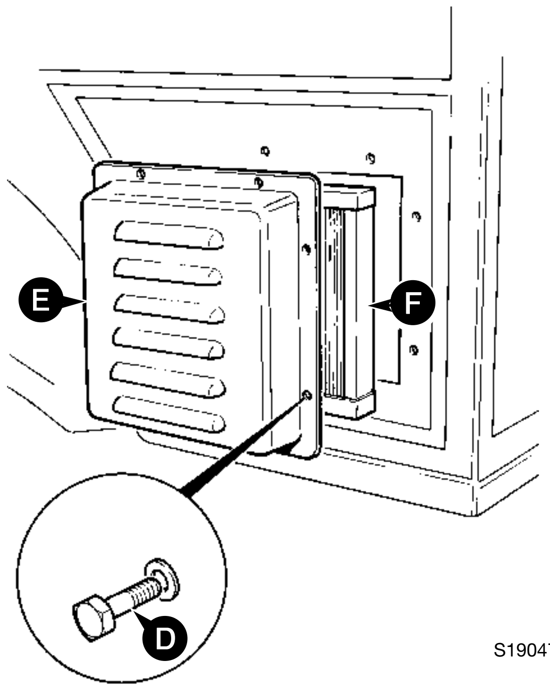
S190480

Air Intake Filter - Clean

1 Stop the engine and remove the starter key.

2 Remove Screws **D**, air intake cover **E** and filter **F.**

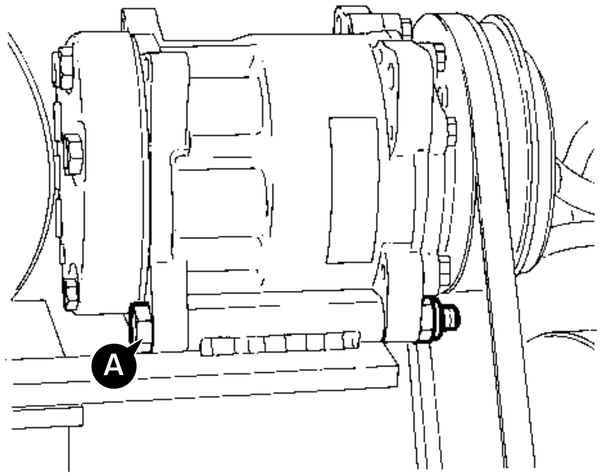
Clean filter element using compressed air. Refit filter into the cover and refit.

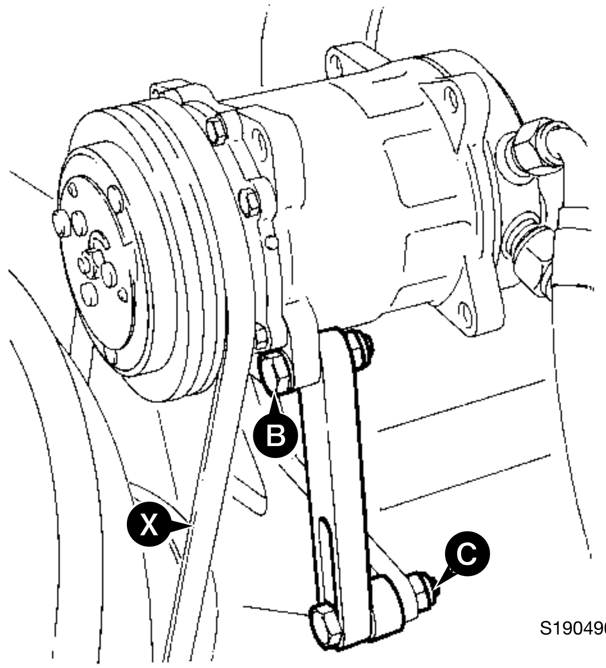


S190470

Air Conditioning

Compressor Drive Belt - Adjusting





S190490

1 Park the machine on firm level ground. Raise and block the loader arms. Lower the backhoe to the ground and stop the engine.

2 Remove the starter key.

⚠ WARNING

Make sure the engine cannot be started. Disconnect the battery before doing this job.

2-3-3-5

3 Raise the Bonnet

4 Remove both Side Panels

5 Loosen pivot fastening bolt **A**. Loosen adjustment link fastening bolts **B** and **C**.

6 Position the compressor so that there is approximately 10 mm (3/8 in) slack at point **X** midway along the belt.

7 Tighten bolts **A**, **B** and **C**. Make sure that bolt **A** is the last to be tightened.

Note: If a new belt is fitted, check the belt tension after the first 20 hours of operation.

Glazing

The glass panes on the cab are all direct glazed.

Direct Glazing

The following procedures explain how to correctly remove and install panes of glass that are directly bonded to the cab frame apertures. When carrying out the procedures, relevant safety precautions must be taken:

1 Always wear safety glasses during both removal and replacement.

2 Use protective gloves - heavy duty leather gauntlet type gloves when cutting out the broken glass; 'non-slip' type gloves when handling/moving panes of glass; surgical type gloves when using the polyurethane adhesives.

3 Wear protective overalls.

4 DO NOT smoke - the activators and primers used in the procedures are highly flammable.

5 Do not attempt to handle or move panes of glass unless you are using glass lifters, refer to **Service Tools**.

Removing the Broken Glass and Old Sealant

Several special tools are required to successfully complete the removal and replacement procedures. Reference is made to the tools in the text. The majority of these tools can be obtained locally and the remainder from JCB Service, refer to **Service Tools**.

The work must only be carried out in a dry, frost free environment. A protective canopy may be required or the machine/frame must be moved to a sheltered area. In damp or wet conditions, hinged doors and window frames can be removed from the machine and taken to a more suitable (dry) environment.

Glass should not be replaced at temperatures below 5°C (41°F).

A toughened pane will shatter and fall apart.

⚠ WARNING

Always wear safety glasses when removing or installing screen glass. Never use a power operated knife when removing the sealant around a toughened glass screen. The action of the knife could cause particles of glass to be thrown with sufficient force to cause serious injury, even when safety glasses are being worn. Use only hand operated tools when working with toughened glass.

BF 2-3/1

1 Position the machine on level ground and apply the parking brake. Stop the engine. Put protective covers over the cab seat and control pedestals.

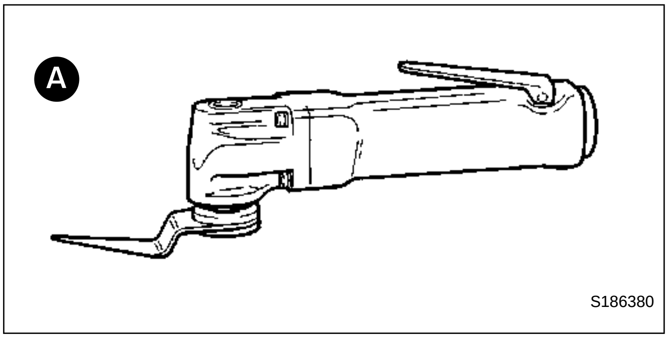
2 Remove as much of the shattered glass as possible prior to cutting out the old sealant.

Direct Glazing (cont'd)

Removing the Broken Glass and Old Sealant (cont'd)

3 Cut out the old sealant, leaving approximately 1 to 2 mm on the cab frame. There are several tools and techniques for doing this:

a Pneumatic Knife **A** provides one of the easiest methods of removing the sealant around laminated glass. The tool, powered by compressed air, should be sourced locally.



Note: This tool must not be used on toughened glass (see **WARNING** on previous page).

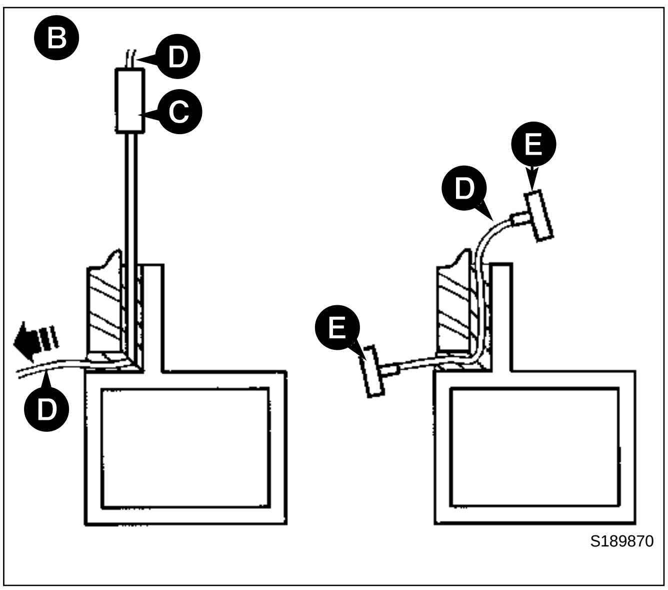
(i) Press the handle to start the knife blade oscillating.

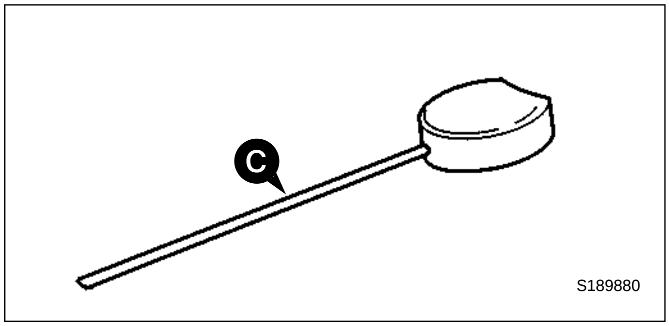
(ii) Insert the knife blade into the sealant.

(ii) Slowly move the knife along the sealant with the blade positioned as close to the glass as possible. Do not allow the knife blade to overheat or the sealant will melt.

b Braided Cutting Wire and Handles **B**. This method uses a 3-core wire, a wire starter tube and two handles, refer to **Service Tools**.

(i) Insert the steel tube **C** into the old sealant on the inside of the glass.





(ii) Insert the braided cutting wire **D** down the centre of the steel tube. If necessary, from the outside, cut out local sealant at the point of the tube to gain access to the wire.

(iii) Using suitable pliers, pull the cutting wire through the sealant to the outer side of the glass.

(iv) Secure each end of the braided cutting wire in the special handles **E**.

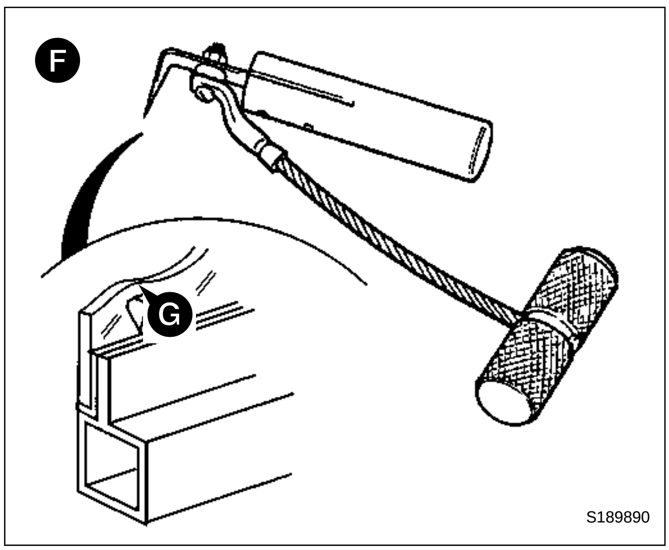
(v) Move the cutting wire backwards and forwards in a sawing motion and at the same time gently push or pull the wire to cut through the old sealant.

c Cut-out Knife **F**. The cut-out knife can be used as a left handed or right handed tool. For the knife and its replaceable blades, refer to **Service Tools**.

(i) Insert the knife blade into the sealant.

(ii) Make sure that the blade of the knife is against the glass as shown at **G**.

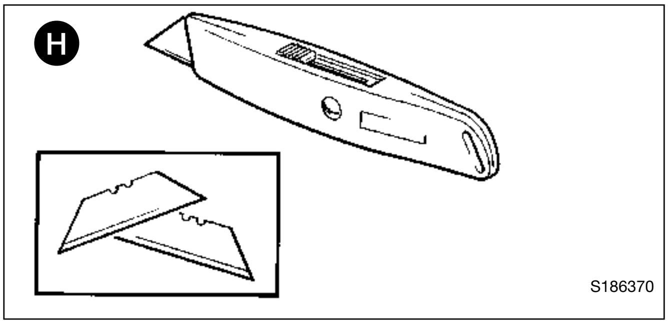
(iii) Use the 'pull-handle' to pull the knife along and cut out the old sealant.



Direct Glazing (cont'd)

Removing the Broken Glass and Old Sealant (cont'd)

d Craft Knife **H**. The blades are replaceable.



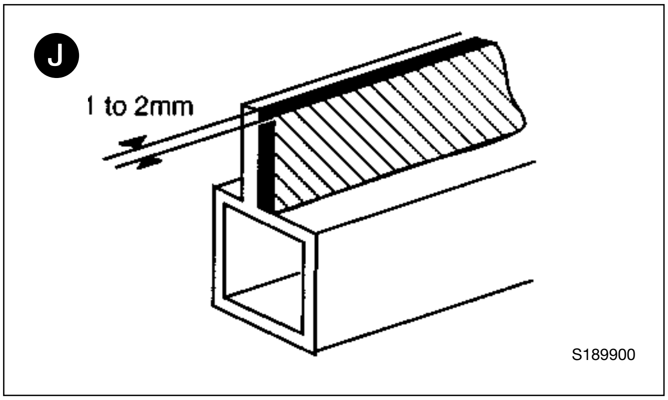
(i) Insert the knife blade into the sealant.

(ii) Pull the knife along and cut out the old sealant.

Note: There are other tools available to cut out the old sealant. For example, there is a long handle type craft knife to give extended reach. Refer to **Service Tools**, for details of this and any other tools.

4 Remove the cut off sealant and all remaining particles of shattered glass.

5 If necessary, trim off the remaining old sealant to leave approximately 1 to 2 mm on the upright face of the cab frame aperture, as shown at **J**.



6 Apply a coat of 'Black Primer 206J' to the paintwork if:

a Paintwork was damaged or scratched during the glass/sealant removal procedures.

b The old sealant was inadvertently cut back to the cab frame during the glass/sealant removal procedures.

Preparing the Cab Frame Aperture

1 If damp or wet, dry the aperture area using a hot air gun (sourced locally).

2 Use 'Active Wipe 205' to thoroughly clean and 'prime' the trimmed sealant. Use a lint free cloth to apply the 'Active Wipe 205', allow 5 minutes flash off (drying) time.

Note: Do not use any other type of cleaning fluids, otherwise they may be absorbed into the old sealant and ultimately prevent the new glass from bonding.

Preparing the New Glass

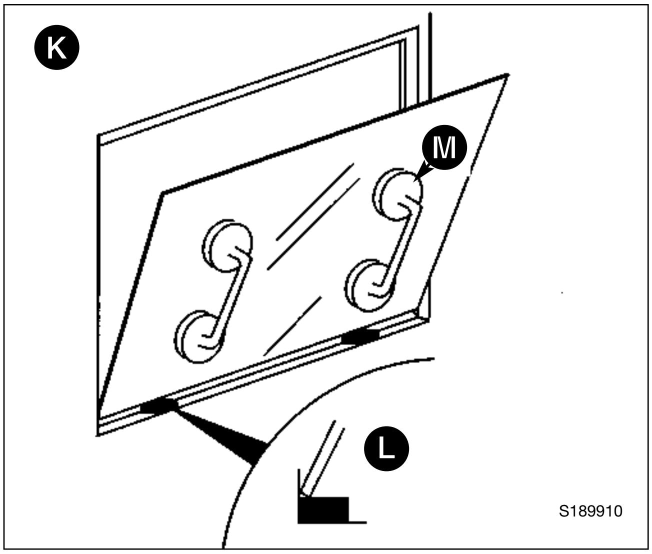
1 Make sure that the new glass correctly fits the frame aperture **K**.

a Put two spacer blocks **L** onto the bottom part of the frame aperture.

b Install the new glass on the spacer blocks - ALWAYS USE GLASS LIFTERS **M**, refer to **Service Tools**. Check that there is an equal sized gap all round the edge of the glass.

Note: The spacer blocks are rectangular in section to give two common gap widths. If necessary they can be trimmed to a smaller size to give an equal sized gap around the glass.

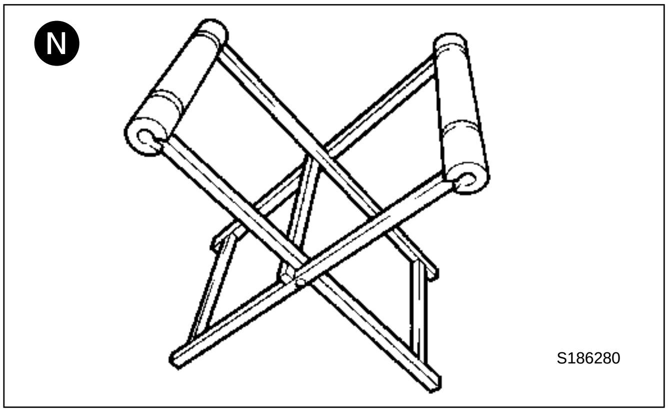
IMPORTANT: The glass edges MUST NOT touch the frame, otherwise movement of the frame will chip and eventually break the newly installed glass.



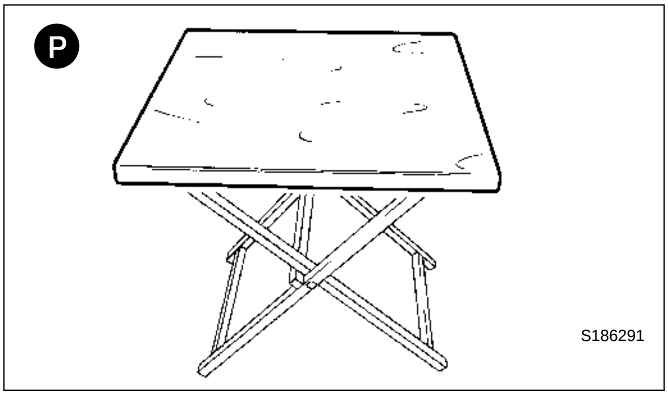
Direct Glazing (cont'd)

Preparing the New Glass (cont'd)

2 After checking for size, remove the new glass and place it on a purpose made glass stand **N**, refer to **Service Tools**.



Small panes of glass will need locating on a 600 x 700 mm x 15 to 19 mm thick plywood board **P** (sourced locally to fit the glass stand **N**). It is recommended that an access hole is cut in the board to accommodate the glass lifter, making it easier and safer to handle small panes of glass. The board should be covered with felt or carpet to give an anti-scratch surface. Resting the glass on four spacer blocks will ensure clearance of the cartridge nozzle tip during application of the polyurethane sealant.

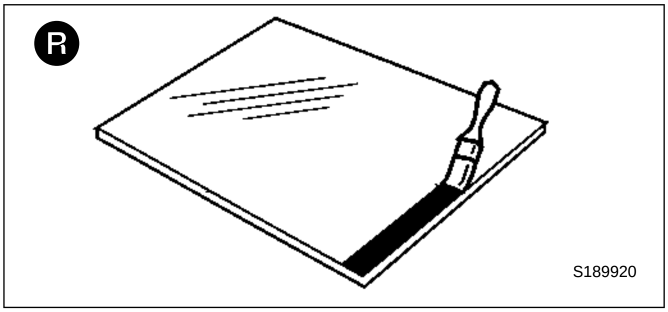


3 Make sure the glass is positioned on the stand the correct way up (i.e. with the black ceramic ink band upwards) ready for application of primer etc.

4 **a** Use 'Active Wipe 205' to thoroughly clean and 'prime' the black ceramic ink band printed on the glass (see **Note 1**). Use a lint free cloth to apply the 'Active Wipe 205', allow 5 minutes flash off (drying) time.

Note 1: Do not touch the glass after cleaning with the 'Active Wipe 205'.

b If the glass does not have a black ceramic ink band, paint a band on the glass using 'Black Primer 206J'. The band should be approximately 25mm (1in) wide, and the edge should be a neat straight line as shown at **R**.



5 Install the Ultra Fast Adhesive cartridge,(refer to **Sealing and Retaining Compounds** and **Note 2** below) into a suitable applicator gun:

a Remove the aluminium disc cover from the base of the cartridge and discard the 'dessicant capsule'.

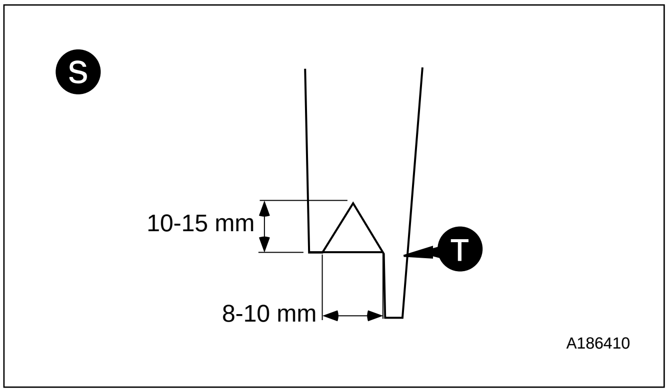
b Make sure that the rolled edge of the cartridge is not damaged - if necessary, the edges should be pressed flat, otherwise it will be difficult to remove the cartridge from the applicator gun.

c Pierce the front 'nozzle' end of the cartridge to its maximum diameter.

d Fit the pre-cut nozzle shown at **S**.

e Install the cartridge in the applicator gun.

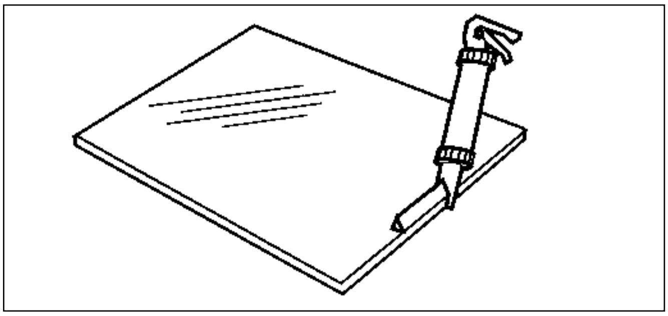
Note 2: Cold material will be very difficult to extrude. The cartridges must be pre-heated in a special oven, (refer to **Service Tools**) for 1 hour to a temperature of 80°C (176°F). Pre-heating the cartridges makes the adhesive more workable and also brings the 'curing' time down to 30 minutes.



Direct Glazing (cont'd)

Preparing the New Glass (cont'd)

6 Apply the pre-heated adhesive to the glass (do not start in a corner). Keep the nozzle guide **T** against the edge of the glass and make sure that the adhesive forms a continuous 'pyramid' shape.



Note 3: Once the pre-heated adhesive has been applied to the glass, install the glass in the aperture as soon as possible. After approximately 10 minutes the sealant will form a 'skin', this will prevent the glass from bonding.

7 After applying the adhesive, leave a small amount of sealant protruding from the nozzle. This will prevent any adhesive left in the cartridge from 'curing'.

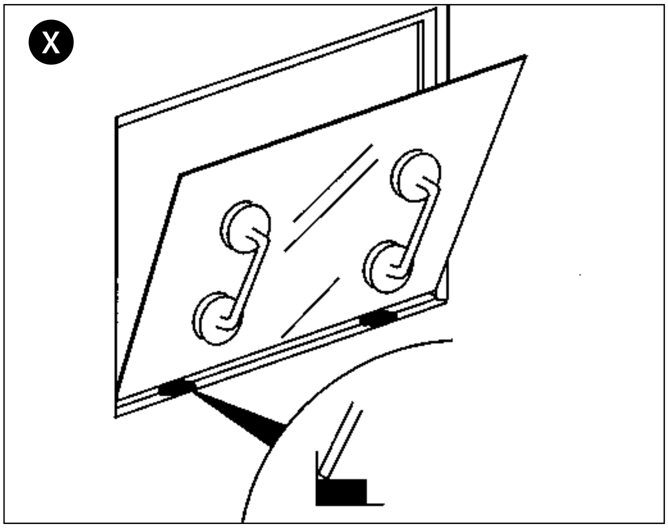
Installing the New Glass

1 Make sure the two spacer blocks are in position (see step 1 of **Preparing the New Glass**).

2 Install the glass in the frame aperture:

a ALWAYS use the special lifting tools when moving the glass.

b Sit the bottom edge of the glass on the spacer blocks as shown **X**.



c Make sure that the glass is correctly positioned, then gently press around the edges of the glass and ensure full adhesive contact is achieved. Do not press too hard or too much adhesive will squeeze out.

3 Make the inside seal smooth:

a Wearing surgical gloves, dip your finger in a soapy water solution.

b Use your finger to make the inside seal smooth.

4 All exposed edges must be sealed using Black Polyurethane Sealant, refer to **Sealing and Retaining Compounds**.

5 Clean the glass after installation:

IMPORTANT: Use extreme caution when wiping the inside of the new glass - pushing too hard on the inside of the glass will affect the integrity of the bonded seal.

a Small amounts of sealant can be cleaned from the glass using the 'Active Wipe 205'.

b Large amounts of excess sealant should be left to 'cure' (see **Note 4**) and then cut off with a sharp knife.

Note 4: On completion of the glass replacement procedures, the sealant 'curing' time is 30 minutes. This means that the machine can be driven and used after 30 minutes, but it MUST NOT be used during the curing period of 30 minutes.

c Clean the glass using a purpose made glass cleaner.

6 On completion of the glass installation procedures tidy the work area:

a Remove ALL broken glass from the cab area.

b Remove the protective covers from the cab seat and control pedestals.

c Renew all 'warning' and 'information' decals so that the new installation conforms with the original cab installation.

Cab ROPS/FOPS Structure - Checks

⚠ WARNING

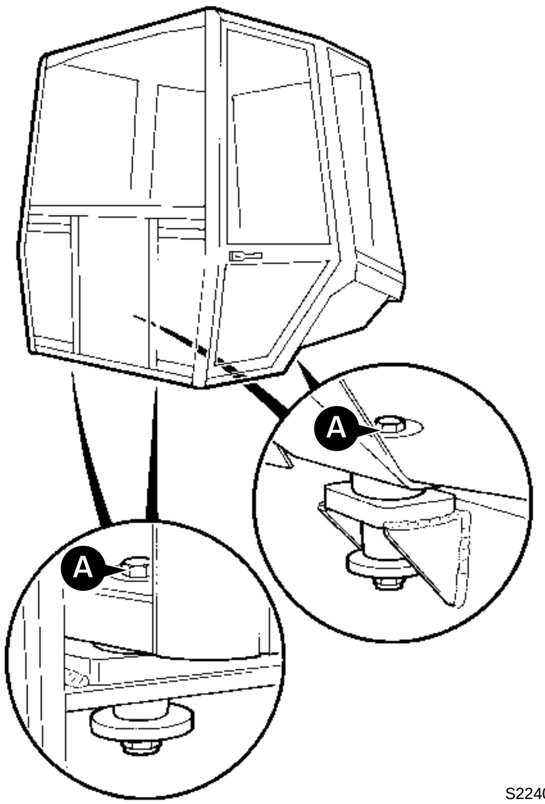
The machine is fitted with a Roll Over Protection Structure (ROPS) and a Falling Objects Protection Structure (FOPS). You could be killed or seriously injured if you operate the machine with a damaged or missing ROPS/FOPS. If the ROPS/FOPS has been in an accident, do not use the machine until the structure has been renewed. Modifications and repairs that are not approved by the manufacturer may be dangerous and will invalidate the ROPS/FOPS certification.

INT-2-1-9/3

Failure to take these precautions could result in death or injury to the operator.

1 Check the structure for damage.

2 Check that the mounting bolts are installed and undamaged. Check the bolt torques. Tighten them to the correct torque if necessary. Torque-tighten bolts **A** to 200Nm (147lbf ft; 20.5kgf m).



S224070

Stabiliser Leg

Wear Pad Adjustment

Instructions for adjusting the wear pads are described in the maintenance section, refer to Section 3 **Stabiliser Legs - Wear Pad Adjustment**.

Blower Motor

Removal

1 Remove the four screws and the front panel **1** of air conditioning unit.

2 Disconnect the electrical connections from the resistor **2**.

3 Remove the four screws securing the resistor. Remove the resistor and the blower unit **3**.

Note: The resistor unit incorporates a bridge which retains the blower unit in position in the air conditioning unit. When the resistor is removed the blower unit is free to be removed.

Replacement

For replacement the sequence should be reversed.

Thermostat

Removal

1 Disconnect the electrical connections from the thermostat **4**.

2 Remove the capillary tube **5** from the evaporator coil **6**. Undo the themostat mounting nut and bolt and remove the thermostat and capillary tube from the unit.

Note: The capillary tube is held in position between the evaporator coil fins.

Replacement

For replacement the sequence should be reversed.

Take care when fitting not to damage the capillary tube.

Compressor Clutch Relay

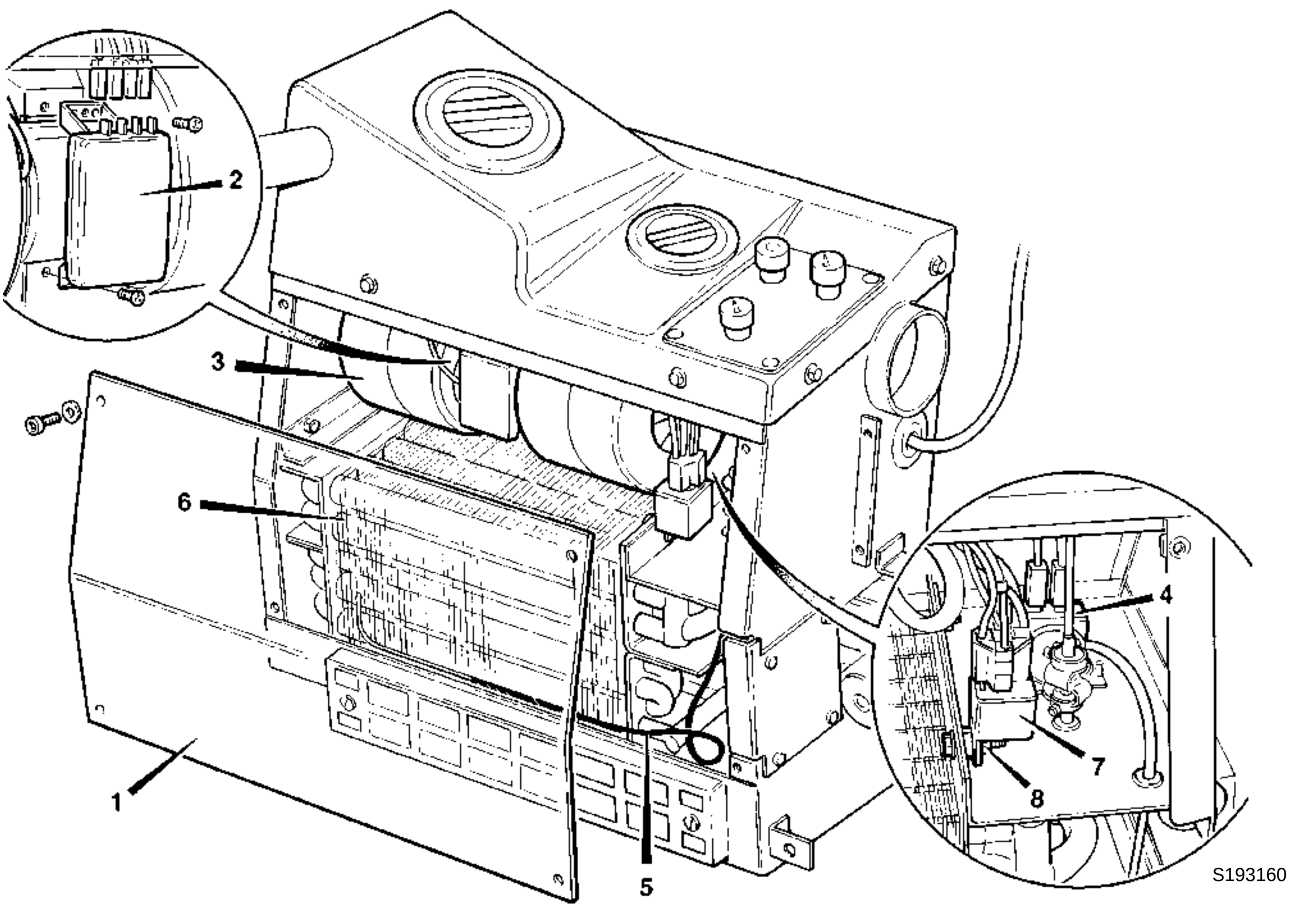
Removal

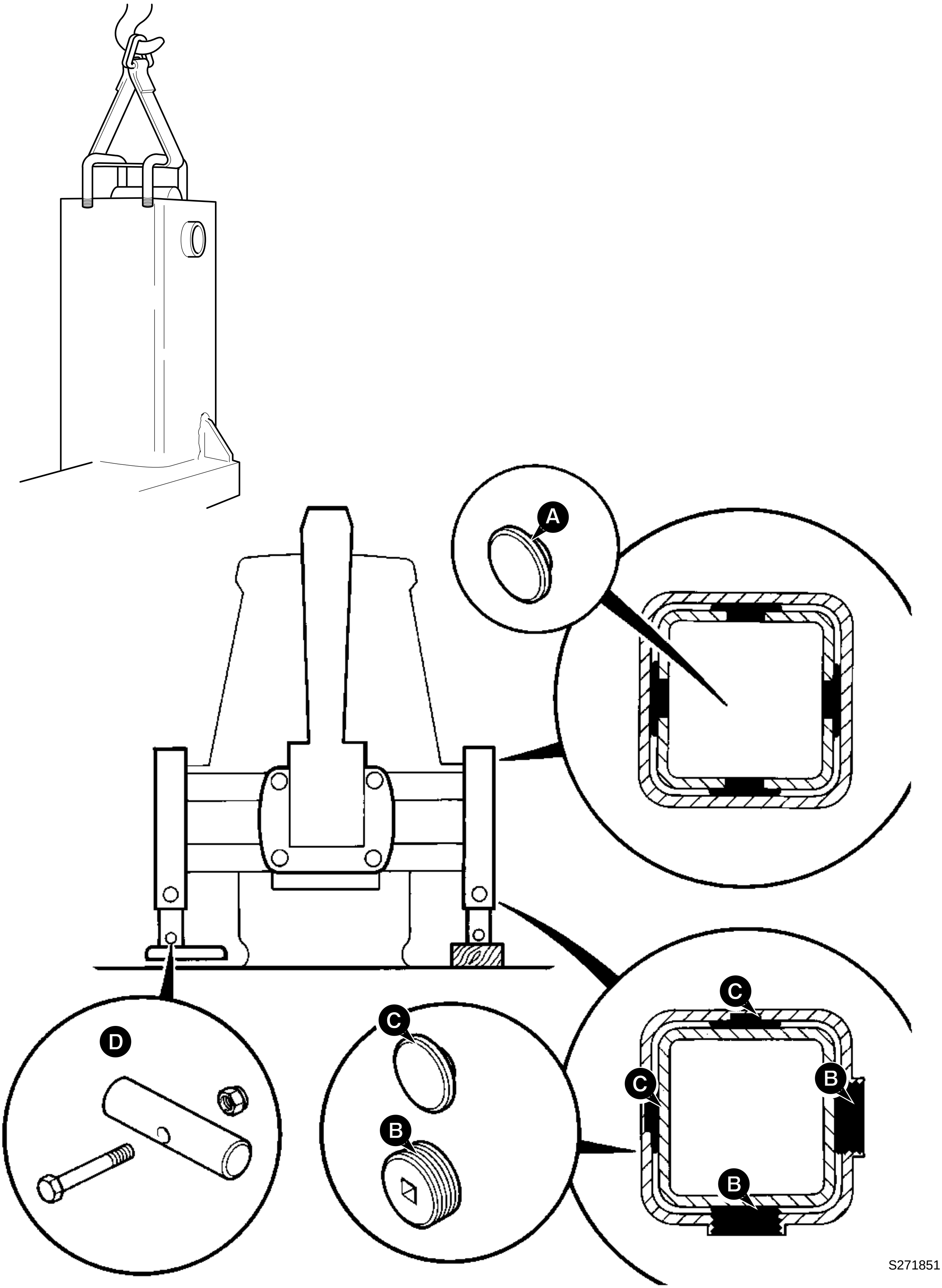
1 Disconnect electrical connections from relay **7**.

2 Undo nut and bolt **8** and remove the relay.

Replacement

For replacement the sequence should be reversed.




A
C
B
C
B
C
B
D
S271851

Removal and Replacement

Removal

1 Park the machine on firm level ground. Engage the parking brake and set the transmission to neutral.

2 Lower the loader shovel to the ground.

3 Make sure that the backhoe assembly is set central to the mainframe as shown. If necessary 'sideshift' the backhoe into a central position.

4 Remove the stabiliser foot **D**, refit pivot pin to engage stabiliser ram.

5 Remove the inner leg:

a Dissconnect hydralic hoses to stabilser ram.

b Use suitable lifting equipment, lift the inner leg clear.

c Remove the wear pads.

Replacement

Replacement is a reversal of the removal sequence.

Select suitable size upper pads **A** to achieve a maximum permissible float of 1 mm (0.039 in).

Make sure that the bottom pads **C** are held in position before guiding the inner leg into position. If the lower pads are not secured then the inner leg could dislodge the pads during assembly.

When the inner leg is in position adjust the bottom pads, refer to Section 3 **Stabiliser Legs - Wear Pad Adjustment**.

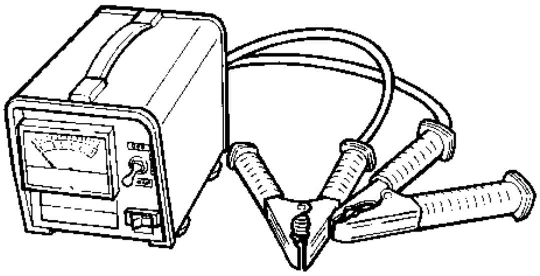
Apply a high pressure grease such as JCB HP Grease (part number 4003/2000) to the threads of pad **B**.

Contents

Page No.

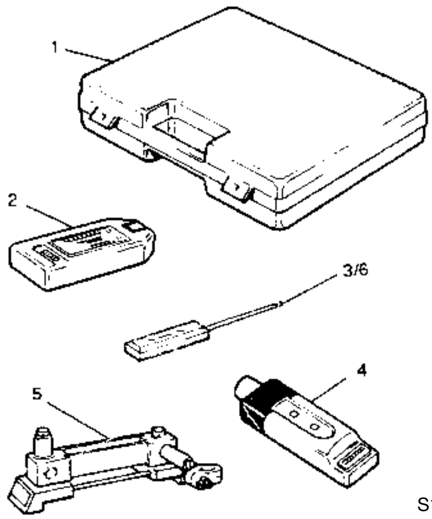
Service Tools

993/85700 Battery Tester



Wiring Harness Repair Tools

1	892/00350	Butane Heater Assembly
2	892/00349	Crimp Tool
3	892/00351	Splice 0.5 - 1.5mm (Red)
4	892/00352	Splice 1.5 - 2.5mm (Blue)
5	892/00353	Splice 3.0 - 6.0mm (Yellow)



S188230

AVO Test Kit

1	892/00283	Tool Kit Case
2	892/00298	Fluke Meter 85
3	892/00286	Surface Temperature Probe
4	892/00284	Venture Microtach Digital Tachometer
5	892/00282	100 amp Shunt - open type
6	892/00285	Hydraulic Temperature Probe

System Type

System Type	12 Volt, negative earth
Battery	
Cranking Performance at -18 °C (0 °F)	410 Amps to 1.4 V.P.C.
Reserve Capacity (minutes) for 25 amp load	180
Alternator	A127, 55 Amp max. output
Starter Motor	S12-85 (2M113)

The electrical circuits are protected by fuses. The fuses are located in the front console, underneath cover **A**. If a fuse ruptures, find out why and rectify the fault before fitting a new one.

The fuses are identified using column letters (A, B and C) and row numbers (1 to 9). Note that all the fuses are shown (including optional equipment fuses). Your machine may not be equipped with all the fuses shown on these pages.

Bulbs	Rating (Watts)
Headlights - main	45 W
Headlights - dip	37.5 W
Indicators	21 W (front & rear)
Instruments	1.2 W
Work lights	55 W Halogen (front & rear)
Number plate light	2 x 5 W
Side/tail lights	5W (front & rear)
Interior lights	10 W
Stop lights	21 W (rear)
Beacon	70 W Halogen
Inspection lamp (where fitted)	55 W (floodlight pattern)
Rear Fog	21 W
Warning lights	3 W

Fuses

⚠ CAUTION

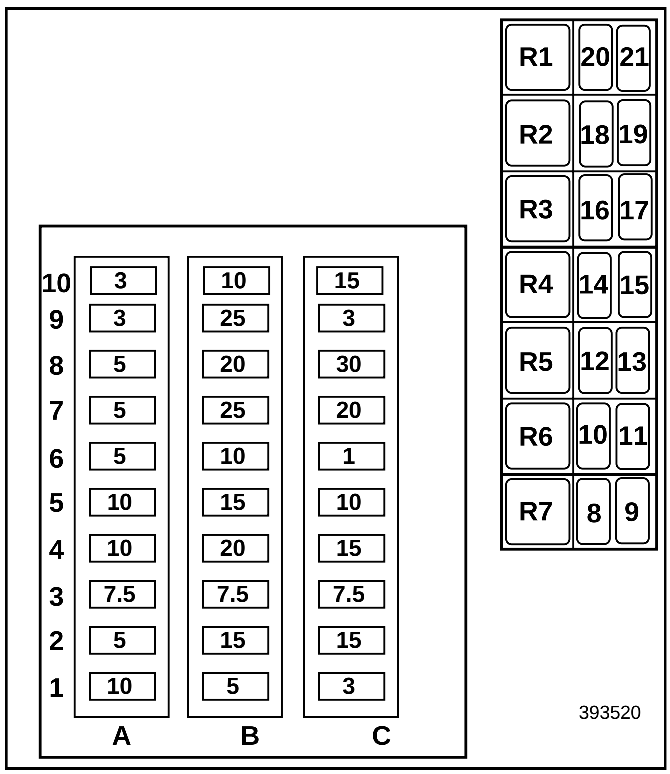
Always replace fuses with ones of correct ampere rating to avoid electrical system damage.
8-3-3-5

The electrical circuits are protected by fuses. The fuses are located in the front console, underneath cover **A**. If a fuse ruptures, find out why and rectify the fault before fitting a new one.

Fuse No.	Circuit	Fuse Rating (Amps)
A1	Junction box, hydraulic tools	10
A2	Engine shut off system	5
A3	Direction indicators	7.5
A4	Creep speed transmission	10
A5	Manual transmission	10
A6	Airmaster (if fitted)	5
A7	Shovel reset, Smooth ride system	5
A8	Brake lights (secondary)	5
A9	Right hand side lights	3
A10	Left hand side lights	3
B1	Tachometer, Gauges	5
B2	Front horn, Front washer/wiper	15
B3	Rear horn	7.5
B4	Auxiliary power socket	20
B5	Rear washer/wiper	15
B6	Brake lights (primary)	10
B7	Rear work lights	25
B8	Lighting, headlights	20
B9	Front work lights	25
B10	Beacon	10
C1	Rear fog light	3
C2	Headlight dip beam	15
C3	Sidelights	7.5
C4	Hazard lights	15
C5	Wiper, Face level fan, Interior light	10
C6	Radio, Hourmeter	1
C7	Thermostart	20
C8	Heater, Air conditioning	30
C9	Starter relays	3
C10	Headlight main beam	15

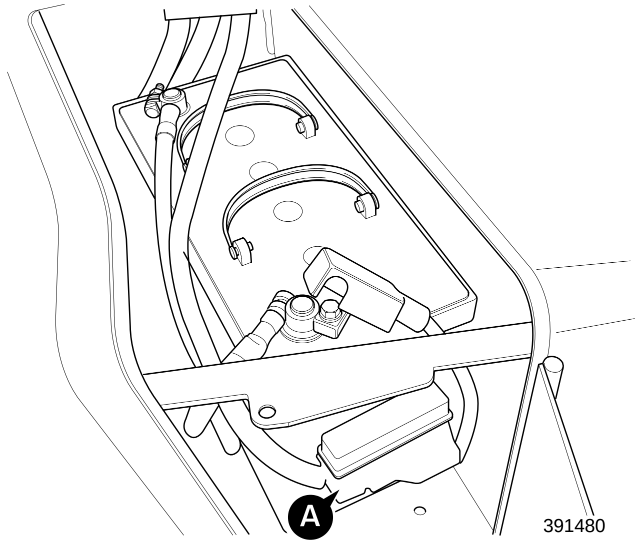
Relays

R1	Indicators
R2	Front working lights
R3	Rear working lights
R4	Starter 1
R5	Starter 2
R6	Buzzer
R7	Neutral start
R8	Blank
R9	Compressor interlock (Airmaster only)
R10	Compressor shutdown (Airmaster only)
R11	Compressor start (Airmaster only)
R12	Parking brake
R13	Transmission dump
R14	Transmission reverse
R15	Transmission forward
R16	Rear horn
R17	Lights
R18	Brake lights
R19	Blank
R20	Blank
R21	Blank



Fuse Link Box

To further protect the machine wiring harnesses and electrical circuits, a fuse link box is fitted to the battery, as shown at **A**. Remember to check the main circuit fuses as well as the link box fuses shown on this page.



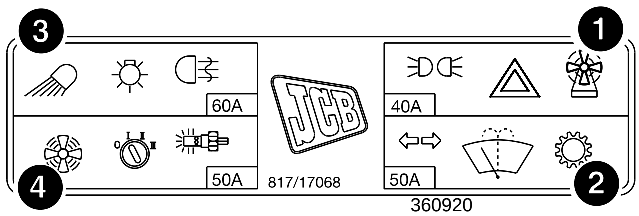
Fuse Links

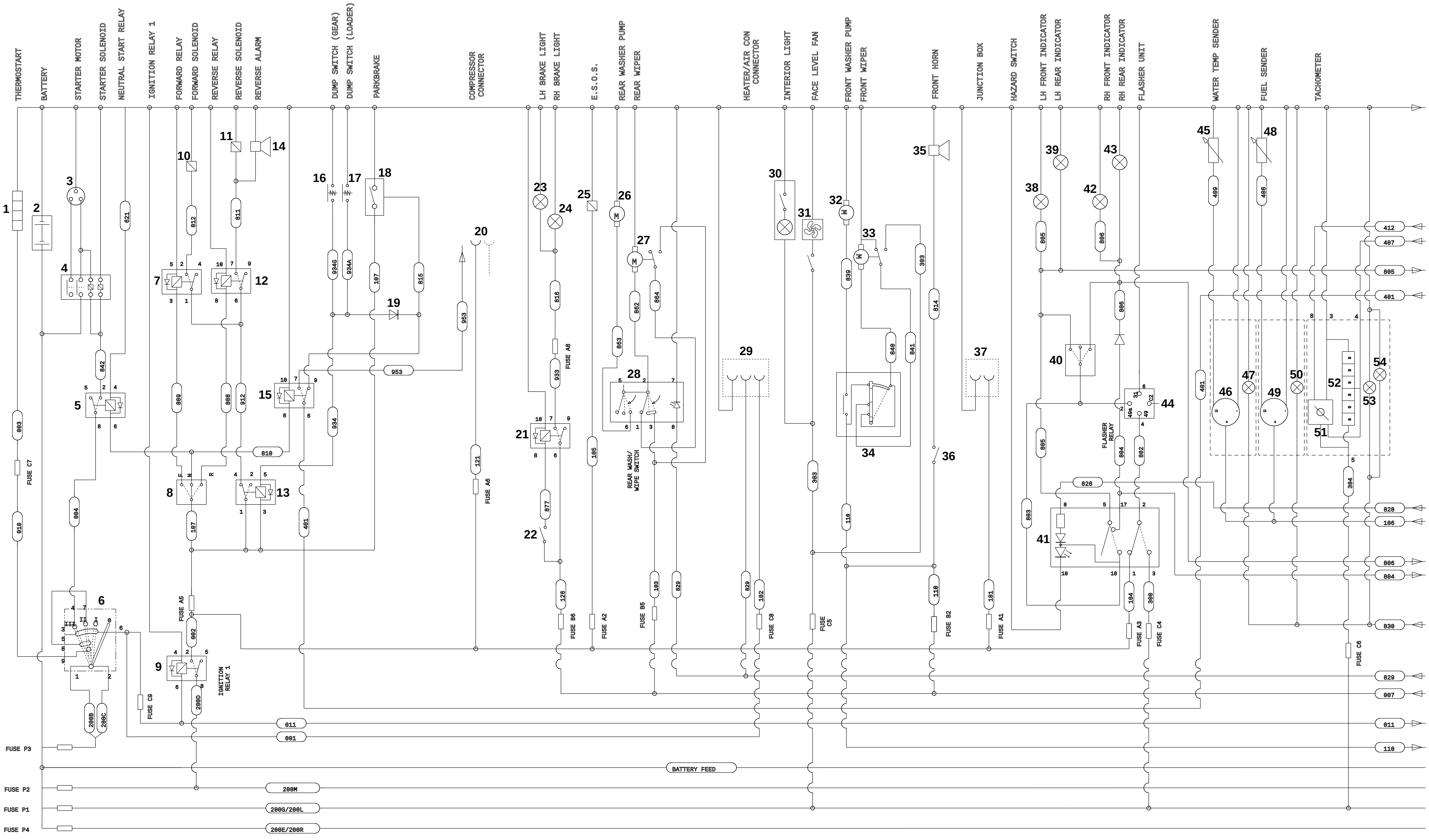
1 Hazard warning lights, sidelights, face level fan.

2 Transmission, indicators, wash/wipe.

3 Worklights, road lights, fog lights.

4 Ignition, Thermostart, heater.




THERMOSTART
BATTERY
STARTER MOTOR
STARTER SOLENOID
NEUTRAL START RELAY
IGNITION RELAY 1
FORWARD RELAY
FORWARD SOLENOID
REVERSE RELAY
REVERSE SOLENOID
REVERSE ALARM
DUMP SWITCH (GEAR)
DUMP SWITCH (LOADER)
PARKBRAKE
COMPRESSOR CONNECTOR
LH BRAKE LIGHT
RH BRAKE LIGHT
E.S.O.S.
REAR WASHER PUMP
REAR WIPER
HEATER/AIR CON CONNECTOR
INTERIOR LIGHT
FACE LEVEL FAN
FRONT WASHER PUMP
FRONT WIPER
FRONT HORN
JUNCTION BOX
HAZARD SWITCH
LH FRONT INDICATOR
LH REAR INDICATOR
RH FRONT INDICATOR
RH REAR INDICATOR
FLASHER UNIT
WATER TEMP SENDER
FUEL SENDER
TACHOMETER
REAR WASH/WIPE SWITCH
FLASHER RELAY
IGNITION RELAY 1
FUSE P3
FUSE P2
FUSE P1
FUSE P4
BATTERY FEED
200M
200G/200L
200E/200R

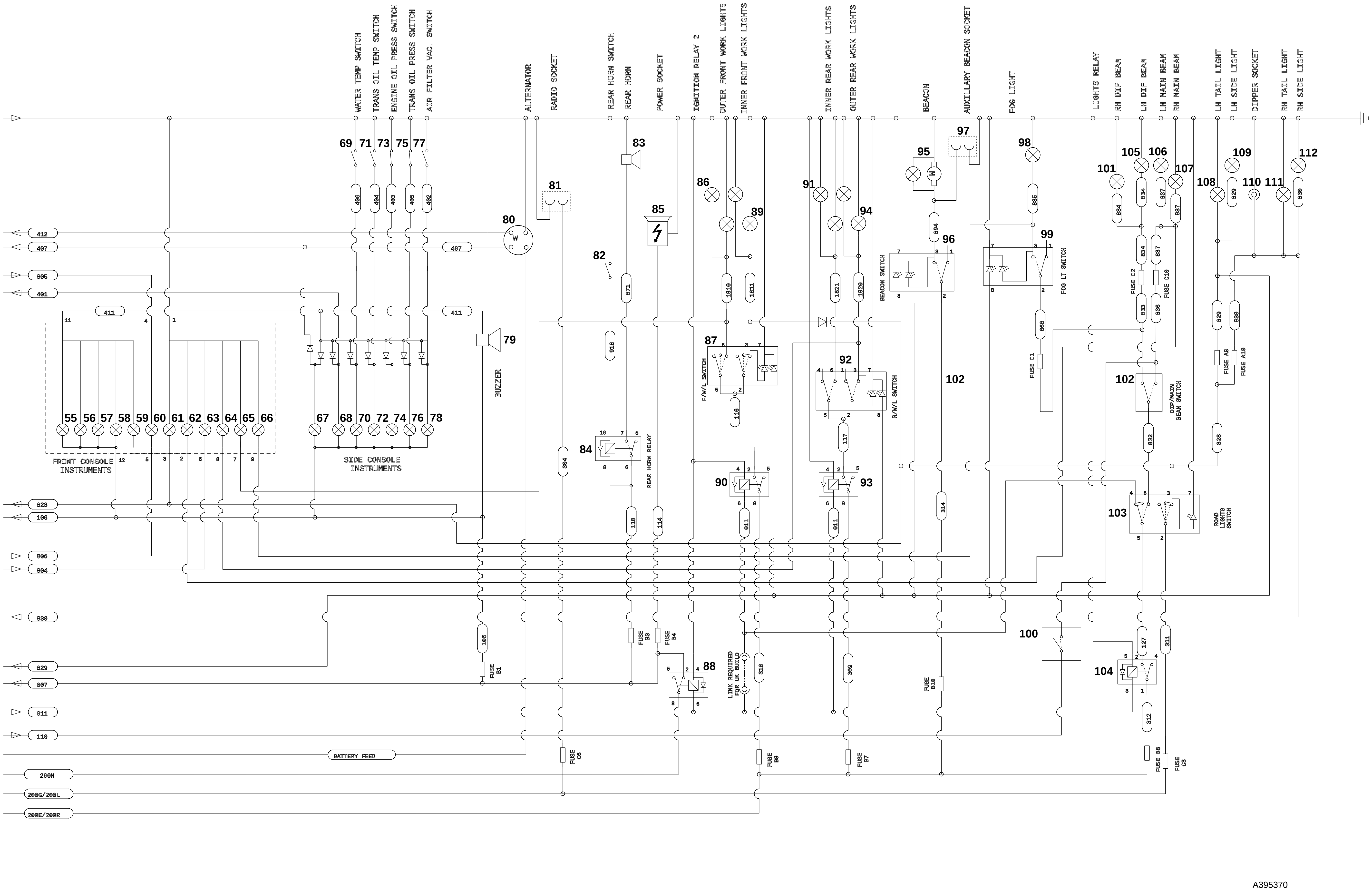
A395410

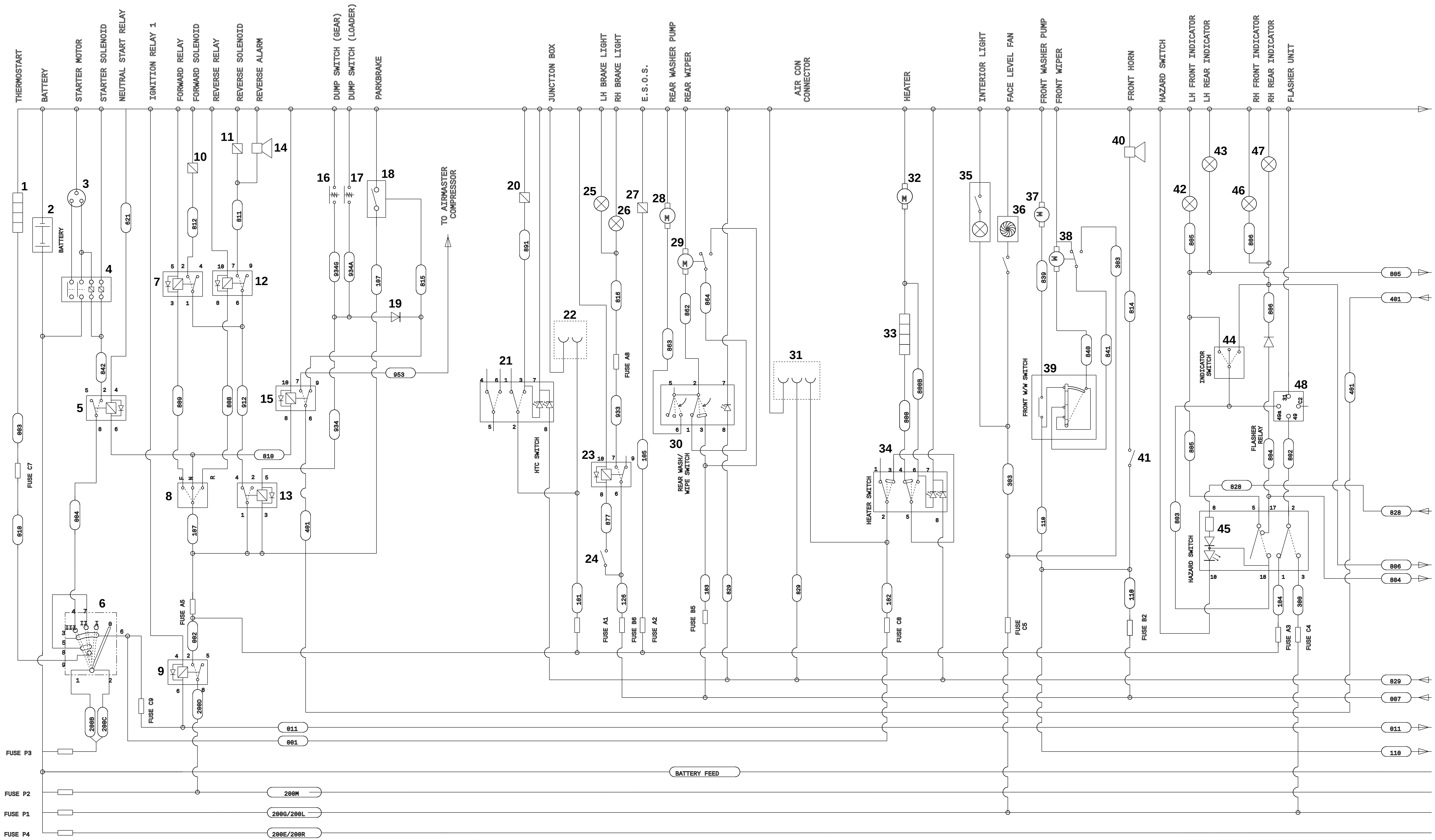
Circuit Schematics

2CX

Component Key:
1 Thermostart
2 Battery
3 Starter Motor
4 Starter Solenoid
5 Neutral Start Relay
6 Ignition Switch
7 Forward Relay
8 Forward/Reverse Switch
9 Ignition Relay 1
10 Forward Solenoid
11 Reverse Solenoid
12 Reverse Relay
13 Transmission Dump Relay
14 Reverse Alarm
15 Parking Brake Relay
16 Dump Switch (Gear Lever)
17 Dump Switch (Loader Lever)
18 Parking Brake Switch
19 Diode
20 Compressor Connector
21 Brakes Relay
22 Brake Lights Switch
23 LH Brake Light
24 RH Brake Light
25 Engine Shut-Off Solenoid (E.S.O.S)
26 Rear Windscreen Washer Pump Motor
27 Rear Windscreen Wiper Motor
28 Rear Windscreen Wash/Wipe Switch
29 Heater/Air Conditioning Connector
30 Cab Interior Light
31 Face Level Fan
32 Front Windscreen Washer Pump Motor
33 Front Windscreen Wiper Motor
34 Front Windscreen Wash/Wipe Switch
35 Front Horn
36 Front Horn Switch
37 Junction Box
38 LH Front Indicator Light
39 LH Rear Indicator Light
40 Turn Signal Indicator Switch
41 Hazard Warning Switch
42 RH Front Indicator Light
43 RH Rear Indicator Light
44 Flasher Relay
45 Water Temperature Sender
46 Water Temperature Gauge
47 Illumination Light
48 Fuel Level Sender
49 Fuel Level Gauge
50 Illumination Light
51 Tachometer
52 Hourmeter
53 Illumination Light
54 Illumination Light
55 Front Instrument Console Warning Lights
56 Front Instrument Console Warning Lights
57 Front Instrument Console Warning Lights
58 Front Instrument Console Warning Lights
59 2 Wheel Steer Selected Warning Light
60 Turn Signal Indicator Warning Light
61 Side Lights Warning Light
62 Main Beam Warning Light
63 Hazard Warning Light
64 Rear Work Lights Warning Light
65 Front Work Lights Warning Light
66 Rear Fog Light Warning Light
67 Alternator No Charge Warning Light
68 Parking Brake Warning Light
69 Water Temperature Switch
70 Water Temperature Warning Light
71 Transmission Oil Temperature Switch
72 Transmission Oil Temperature Warning Light
73 Engine Oil Pressure Switch
74 Engine Oil Pressure Warning Light
75 Transmission Oil Pressure Switch
76 Transmission Oil Pressure Warning Light
77 Air Filter Vaccum Switch
78 Air Filter Blocked Warning Light
79 Buzzer
80 Alternator
81 Radio Socket
82 Rear Horn Switch
83 Rear Horn
84 Rear Horn Relay
85 Power Socket
86 Outer Front Work Lights
87 Front Work Lights Switch
88 Ignition Relay 2
89 Inner Front Work Lights
90 Relay
91 Inner Rear Work Lights
92 Rear Work Lights Switch
93 Relay
94 Outer Rear Work Lights
95 Beacon
96 Beacon Switch
97 Auxillary Beacon Socket
98 Fog Light
99 Fog Light Switch
100 Head Light Flash Switch
101 RH Dip Beam Light
102 Dip/Main Beam Switch
103 Road Lights Switch
104 Road Lights Relay
105 LH Dip Beam Light
106 LH Main Beam Light
107 RH Main Beam Light
108 LH Tail Light
109 LH Side Light
110 Dipper Socket
111 RH Tail Light
112 RH Side Light

Fuses:
A1 - A10
B1 - B10
C1 - C10
For fuse details refer to **Technical Data**.


WATER TEMP SWITCH
TRANS OIL TEMP SWITCH
ENGINE OIL PRESS SWITCH
TRANS OIL PRESS SWITCH
AIR FILTER VAC. SWITCH
ALTERNATOR
RADIO SOCKET
REAR HORN SWITCH
REAR HORN
POWER SOCKET
IGNITION RELAY 2
OUTER FRONT WORK LIGHTS
INNER FRONT WORK LIGHTS
INNER REAR WORK LIGHTS
OUTER REAR WORK LIGHTS
BEACON
AUXILLARY BEACON SOCKET
FOG LIGHT
LIGHTS RELAY
RH DIP BEAM
LH DIP BEAM
LH MAIN BEAM
RH MAIN BEAM
LH TAIL LIGHT
LH SIDE LIGHT
DIPPER SOCKET
RH TAIL LIGHT
RH SIDE LIGHT
FRONT CONSOLE INSTRUMENTS
SIDE CONSOLE INSTRUMENTS
BUZZER
REAR HORN RELAY
F/W/L SWITCH
R/W/L SWITCH
BEACON SWITCH
FOG LT SWITCH
DIP/MAIN BEAM SWITCH
ROAD LIGHTS SWITCH
LINK REQUIRED FOR UK BUILD
BATTERY FEED
200M
200G/200L
200E/200R
A395370



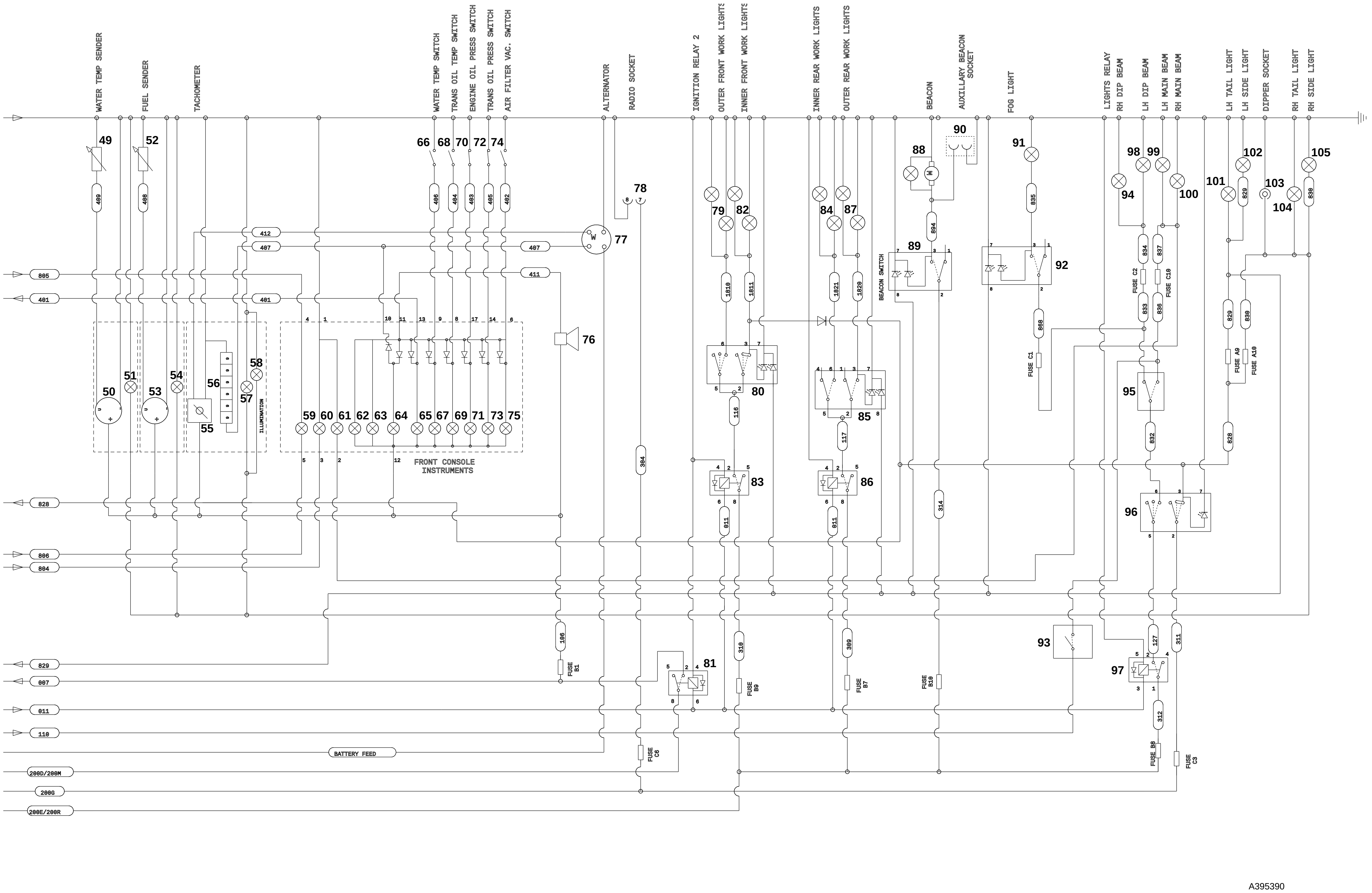
A395380

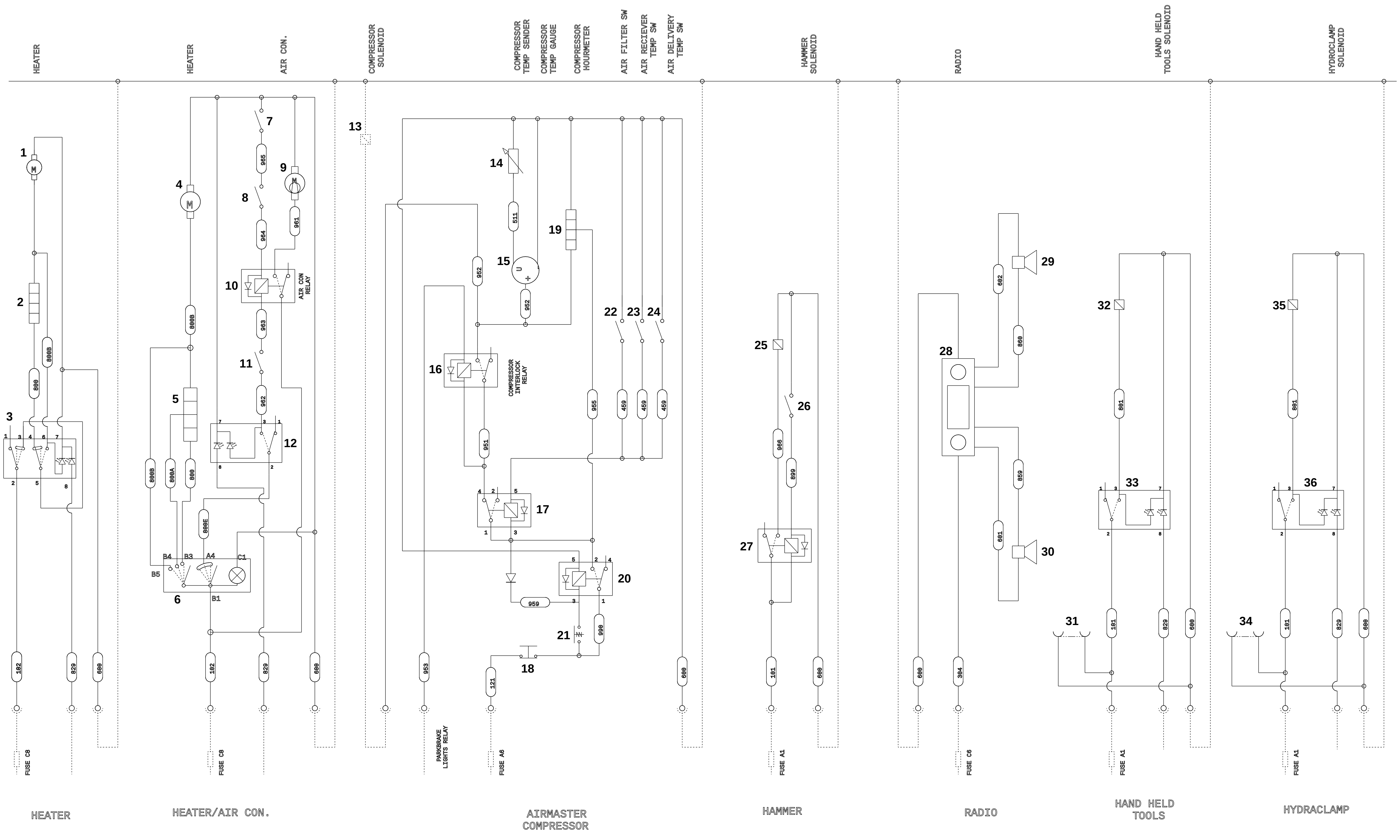
Circuit Schematics

212SU Utility

Component Key:
1 Thermostart
2 Battery
3 Starter Motor
4 Starter Solenoid
5 Neutral Start Relay
6 Ignition Switch
7 Forward Relay
8 Forward/Reverse Switch
9 Ignition Relay 1
10 Forward Solenoid
11 Reverse Solenoid
12 Reverse Relay
13 Transmission Dump Relay
14 Reverse Alarm
15 Parking Brake Relay
16 Dump Switch (Gear Lever)
17 Dump Switch (Loader Lever)
18 Parking Brake Switch
19 Diode
20 Hydraulic Tools Circuit Solenoid (H.T.C)
21 Hydraulic Tools Circuit Switch (H.T.C)
22 Junction Box
23 Brakes Relay
24 Brake Lights Switch
25 LH Brake Light
26 RH Brake Light
27 Engine Shut-Off Solenoid (E.S.O.S)
28 Rear Windscreen Washer Pump Motor
29 Rear Windscreen Wiper Motor
30 Rear Windscreen Wash/Wipe Switch
31 Heater/Air Conditioning Connector
32 Cab Heater Fan Motor
33 Cab Heater Resistor
34 Cab Heater Switch
35 Cab Interior Light
36 Face Level Fan
37 Front Windscreen Washer Pump Motor
38 Front Windscreen Wiper Motor
39 Front Windscreen Wash/Wipe Switch
40 Front Horn
41 Front Horn Switch
42 LH Front Indicator Light
43 LH Rear Indicator Light
44 Turn Signal Indicator Switch
45 Hazard Warning Switch
46 RH Front Indicator Light
47 RH Rear Indicator Light
48 Flasher Relay
49 Water Temperature Sender
50 Water Temperature Gauge
51 Illumination Light
52 Fuel Level Sender
53 Fuel Level Gauge
54 Illumination Light
55 Tachometer
56 Hourmeter
57 Illumination Light
58 Illumination Light
59 Turn Signal Indicator Warning Light
60 Hazard Warning Light
61 Main Beam Warning Light
62 Front Instrument Console Warning Lights
63 Front Instrument Console Warning Lights
64 Alternator No Charge Warning Light
65 Parking Brake Warning Light
66 Water Temperature Switch
67 Water Temperature Warning Light
68 Transmission Oil Temperature Switch
69 Transmission Oil Temperature Warning Light
70 Engine Oil Pressure Switch
71 Engine Oil Pressure Warning Light
72 Transmission Oil Pressure Switch
73 Transmission Oil Pressure Warning Light
74 Air Filter Vaccum Switch
75 Air Filter Blocked Warning Light
76 Buzzer
77 Alternator
78 Radio Socket
79 Outer Front Work Lights
80 Front Work Lights Switch
81 Ignition Relay 2
82 Inner Front Work Lights
83 Relay
84 Inner Rear Work Lights
85 Rear Work Lights Switch
86 Relay
87 Outer Rear Work Lights
88 Beacon
89 Beacon Switch
90 Auxillary Beacon Socket
91 Fog Light
92 Fog Light Switch
93 Head Light Flash Switch
94 RH Dip Beam Light
95 Dip/Main Beam Switch
96 Road Lights Switch
97 Road Lights Relay
98 LH Dip Beam Light
99 LH Main Beam Light
100 RH Main Beam Light
101 LH Tail Light
102 LH Side Light
103 Dipper Socket
104 RH Tail Light
105 RH Side Light

Fuses:
A1 - A10
B1 - B10
C1 - C10
For fuse details refer to **Technical Data**.


WATER TEMP SENDER
FUEL SENDER
TACHOMETER
WATER TEMP SWITCH
TRANS OIL TEMP SWITCH
ENGINE OIL PRESS SWITCH
TRANS OIL PRESS SWITCH
AIR FILTER VAC. SWITCH
ALTERNATOR
RADIO SOCKET
IGNITION RELAY 2
OUTER FRONT WORK LIGHTS
INNER FRONT WORK LIGHTS
INNER REAR WORK LIGHTS
OUTER REAR WORK LIGHTS
BEACON
AUXILLARY BEACON SOCKET
FOG LIGHT
LIGHTS RELAY
RH DIP BEAM
LH DIP BEAM
LH MAIN BEAM
RH MAIN BEAM
LH TAIL LIGHT
LH SIDE LIGHT
DIPPER SOCKET
RH TAIL LIGHT
RH SIDE LIGHT
ILLUMINATION
FRONT CONSOLE INSTRUMENTS
BEACON SWITCH
BATTERY FEED
FUSE B1
FUSE C6
FUSE B9
FUSE B7
FUSE B10
FUSE C1
FUSE C2
FUSE C10
FUSE A9
FUSE A10
FUSE B8
FUSE C3
200D/200M
200G
200E/200R
A395390


HEATER
HEATER
AIR CON.
COMPRESSOR SOLENOID
COMPRESSOR TEMP SENDER
COMPRESSOR TEMP GAUGE
COMPRESSOR HOURMETER
AIR FILTER SW
AIR RECIEVER TEMP SW
AIR DELIVERY TEMP SW
HAMMER SOLENOID
RADIO
HAND HELD TOOLS SOLENOID
HYDROCLAMP SOLENOID
AIR CON RELAY
COMPRESSOR INTERLOCK RELAY
PARKBRAKE LIGHTS RELAY
FUSE C8
FUSE A6
FUSE A1
HEATER
HEATER/AIR CON.
AIRMASTER COMPRESSOR
HAMMER
RADIO
HAND HELD TOOLS
HYDRACLAMP

A395400

Circuit Schematics

2CX, 212SU Utillity Options

Cab Heater Circuit

Component Key:
1 Cab Heater Fan Motor
2 Cab Heater Resistor
3 Cab Heater Switch

Cab Heater/Air Conditioning Circuit

Component Key:
4 Cab Heater Fan Motor
5 Cab Heater Resistor
6 Cab Heater Switch
7 High Pressure Switch (Air Conditioning)
8 Low Pressure Switch (Air Conditioning)
9 Compressor Clutch
10 Air Conditioning Relay
11 Freeze Valve Switch
12 Air Conditioning Switch

Airmaster Compressor Circuit

Component Key:
13 Compressor Solenoid (already fitted)
14 Compressor Temperature Sender
15 Compressor Temperature Gauge
16 Compressor Interlock Relay
17 Compressor Shutdown Relay
18 Stop/Start Button
19 Compressor Hourmeter
20 Compressor Start Relay
21 Start Button
22 Air Filter Blocked Switch
23 Air Receiver Temperature Cut-Out Switch
24 Air Delivery Temperature Cut-Out Switch

Hammer Circuit

Component Key:
25 Hammer Solenoid
26 Hammer On/Off Switch
27 Hammer Relay

Radio Circuit

Component Key:
28 Radio Unit
29 Loudspeaker
30 Loudspeaker

Hand Held Hydraulic Tools Circuit

Component Key:
31 Auxillary Feed Socket
32 Hand Held Tools Solenoid
33 Hand Held Tools Selector Switch

Hydraclamp Circuit

Component Key:
34 Auxillary Feed Socket
35 Hydraclamp Solenoid
36 Hydraclamp Selector Switch

Fuses:
A1 - A10
B1 - B10
C1 - C10
For fuse details refer to **Technical Data**.

Battery

Maintenance

To ensure that the battery provides optimum performance the following steps should be observed:

1 Make sure that the electrical connections are clean and tight. Smear petroleum jelly on connectors to prevent corrosion.

2 When applicable - never allow the electrolyte level to fall below the recommended level - 6 mm (1/4 in) above the plates. Use only distilled water for topping up.

3 Keep the battery at least three quarters charged, otherwise the plates may become sulphated (hardened) - this condition makes recharging the battery very difficult.

Extra precautions must be taken when bench charging maintenance free batteries, they are more prone to damage by overcharging than the standard type of battery:

- NEVER boost-charge a maintenance free battery.
- NEVER charge a maintenance free battery at a voltage in excess of 15.8 Volts.
- NEVER continue to charge a maintenance free battery after it begins to gas.

Safety

⚠ WARNING

Batteries give off an explosive gas. Do not smoke when handling or working on the battery. Keep the battery away from sparks and flames.

Battery electrolyte contains sulphuric acid. It can burn you if it touches your skin or eyes. Wear goggles. Handle the battery carefully to prevent spillage. Keep metallic items (watches, rings, zips etc) away from the battery terminals. Such items could short the terminals and burn you.

Set all switches in the cab to OFF before disconnecting and connecting the battery. When disconnecting the battery, take off the earth (-) lead first.

When reconnecting, fit the positive (+) lead first.

Re-charge the battery away from the machine, in a well ventilated area. Switch the charging circuit off before connecting or disconnecting the battery. When you have installed the battery in the machine, wait five minutes before connecting it up.

First Aid - Electrolyte

Do the following if electrolyte:

GETS INTO YOUR EYES

Immediately flush with water for 15 minutes, always get medical help.

IS SWALLOWED

Do not induce vomiting. Drink large quantities of water or milk. Then drink milk of magnesia, beaten egg or vegetable oil. Get medical help.

GETS ONTO YOUR SKIN

Flush with water, remove affected clothing. Cover burns with a sterile dressing then get medical help.
5-3-4-3/1

Battery (cont'd)

Testing

This test is to determine the electrical condition of the battery and to give an indication of the remaining useful 'life'.

Before testing ensure that the battery is at least 75% charged (SG of 1.23 to 1.25 for ambient temperature up to 27°C).

Ensure that the battery is completely disconnected from the vehicle.

Connect up the battery tester (part no. 993/85700) as follows:

1 Set the CHECK/LOAD switch **A** to OFF.

2 Set rocker switch **B** to the battery voltage (12V).

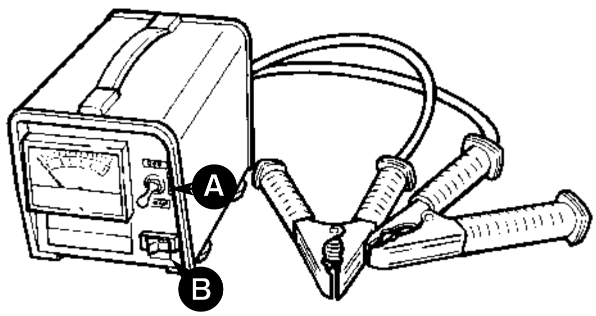
3 Connect the red flying lead to the battery positive (+) terminal and the black flying lead to the battery negative (-) terminal.

4 Set the CHECK/LOAD switch **A** to CHECK to read the battery no-load voltage which should be at least 12.4 volts.

5 Set the CHECK/LOAD switch **A** to LOAD and hold down for 5 - 10 seconds until the meter reading stabilises. The reading should be at least 9 volts.

Note: Do not hold the switch in the LOAD position for more than 10 seconds.

6 If the foregoing tests are unsatisfactory, consult Fault Diagnosis below.



239510

Fault Diagnosis

	Battery Tester Readings	**Remedy**
1	CHECK: 0 - 12.6 Volts LOAD: less than 6 Volts	Renew battery
2	CHECK: 6 - 12.4 Volts LOAD: less than 9 Volts and falls steadily but remains in yellow zone.	Recharge and re-test. If tests still unsatisfactory renew battery.
3	CHECK: less than 10 Volts LOAD: less than 3 Volts	Indicates battery has been over-discharged and unlikely to recover. Renew battery.
4	CHECK: more than 11 Volts LOAD: 6 - 10 Volts steady	Charge battery which will probably recover.

Specific Gravity Testing

The specific gravity of the electrolyte gives an idea of the state of charge of the battery. Readings should be taken using a hydrometer, when the electrolyte temperature is 15 °C (60 °F). If the battery has recently been on charge, wait approximately one hour (or slightly discharge the battery) to dissipate the surface charge before testing.

Readings should be as tabulated and should not vary between cells by more than 0.04. A greater variation indicates an internal fault on that particular cell.

If the electrolyte temperature is other than 15 °C (60 °F) a 'correction factor' must be applied to the reading obtained. Add 0.07 per 10 °C (18 °F) if the temperature is higher than 15 °C (60 °F) and subtract the same if the temperature is lower.

Specific Gravity at 15 °C (60 °F)	Fully Charged	Half Discharged	Fully Discharged
Ambient temperature up to 27 °C (80 °F)	1.270 - 1.290	1.190 - 1.210	1.110 - 1.130
Ambient temperature above 27 °C (80 °F)	1.240 - 1.260	1.170 - 1.190	1.090 - 1.110

Alternator

General Description

The alternator is a three phase generator having a rotating field winding and static power windings.

When the start switch is turned on, current from the battery flows by way of the 'No Charge' warning light to the field winding. This creates a magnetic field which supplements the residual magnetism in the rotor poles. As the engine is started, the fan belt drives the rotor and alternating current is generated in the power windings as they are cut by the rotating magnetic field. Output is controlled by a solid state regulator which varies the field current in accordance with electrical demand.

Servicing is restricted to periodic inspection of slip ring brushes. Bearings are 'sealed for life'.

Service Precautions

a Ensure that the battery negative terminal is connected to the earthing cable.

b Never make or break connections to the battery or alternator, or any part of the charging circuit whilst the engine is running. Disregarding this instruction will result in damage to the regulator or rectifying diodes.

c Main output cables are 'live' even when the engine is not running. Take care not to earth connectors in the moulded plug if it is removed from the alternator.

d During arc welding on the machine, protect the alternator by removing the moulded plug (or if separate output cables fitted, remove the cables).

e If slave starting is necessary, connect the second battery in parallel without disconnecting the vehicle battery from the charging circuit. The slave battery may then be safely removed after a start has been obtained. Take care to connect batteries positive to positive, negative to negative.

Charging Test

Ensure that all battery and alternator connections are in place, secure and making good metal - to - metal contact, especially the 'earth' connections to chassis and engine.

Make sure that the alternator drive belt tension is correctly adjusted.

If the battery is in a fully charged condition, switch on the working lights for 3 minutes before commencing the test. Alternatively, operate the starter for a few moments with the engine shut off solenoid (ESOS) fuse removed (refer to fuse identification pages).

Install a 100 amp open - type shunt between the battery positive lead and the battery positive terminal.

Connect a multimeter positive lead to machine side of the shunt and negative lead to battery side of the shunt.

Connect the leads to the meter and set the meter to the relevant range as follows.

AVO 2002 Red lead to volts (middle) socket on meter.
Black lead to negative on meter.
RH slider to DC voltage.
LH slider as shown in the illustration.

AVO 2003 Red lead to amps socket (marked **A**) on the meter.
Black lead to negative on meter.
RH slider to DC voltage
LH slider to 200 Shunt

FLUKE 85 Red lead to volts socket (marked V)on meter.
Black lead to COM socket on meter.
Set dial to mV.

Start the engine and run at maximum speed (see **Technical Data**). Meter should show maximum alternator output in Amps (see **Technical Data**).

Note: The meter reading should be taken as soon as possible after starting the engine, as the charging current will fall rapidly.

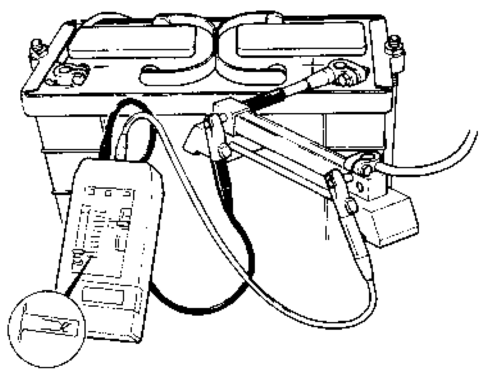
A zero reading indicates failure of the alternator and may be caused by one of the following conditions. These are listed in the order of probability.

a Defective suppression capacitor.
b Dirty slip rings or worn brushes.
c Defective regulator.
d Defective rectifier.
e Open or short - circuited field (rotor) windings.
f Open or short - circuited power (stator) windings.

To check for fault **a**, disconnect the capacitor and repeat the charging test. Renew the capacitor if necessary.

To check for faults **b** and **c**, remove the regulator and brush box assembly. Check the condition of the brushes and, if necessary, clean the slip rings using extra-fine glasspaper. The regulator may only be checked by substitution.

Faults **d**, **e**, and **f** may be checked only by removing and dismantling the alternator for further testing.



S08346

Starter Motor

Starting Circuit Test

Before carrying out the voltmeter tests, check the battery condition (see Battery Testing) and ensure that all connections are clean and tight.

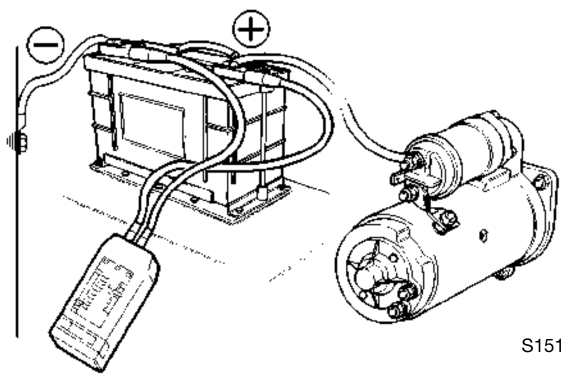
To prevent the engine starting during the tests ensure that the engine stop fuse is removed, (refer to fuse identification page).

Check the readings in the following sequence using a voltmeter. Unless otherwise stated, the readings must be taken with the starter switch held in the 'start' position ('HS') and the transmission forward/reverse selector in neutral.

Note: Do not operate the starter motor for more than 20 seconds at one time. Let the starter motor cool for at least two minutes between starts.

Test 1
Connect the voltmeter across the battery terminals. Reading in 'start' position: 10.0V approximately. Minimum permissible reading in 'start' position 9.5V.

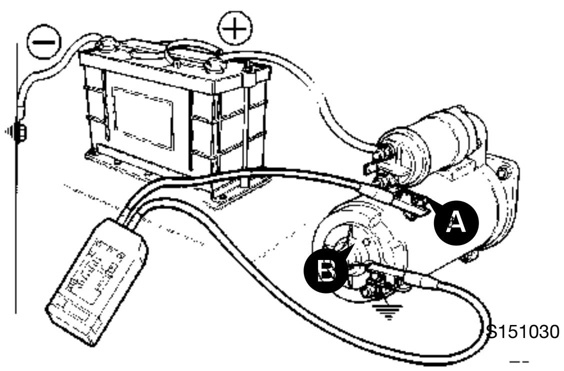
A low reading probably indicates a fault in the starter motor.



S151000

Test 2
Connect the voltmeter between the starter main terminal **A** and the commutator end bracket **B**. In the 'start' position, the reading should not be more than 0.5V below the reading obtained in Test 1. Minimum permissible reading in 'start' position 9.0V.

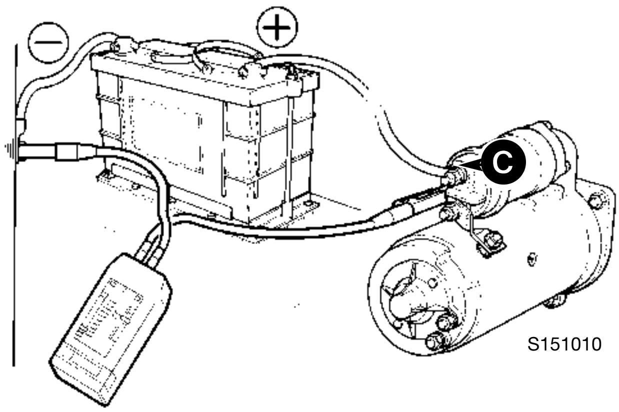
If the reading is within this limit, continue to Test 3. If the reading is outside the limit, proceed to Tests 4 and 5.



S151030

Test 3

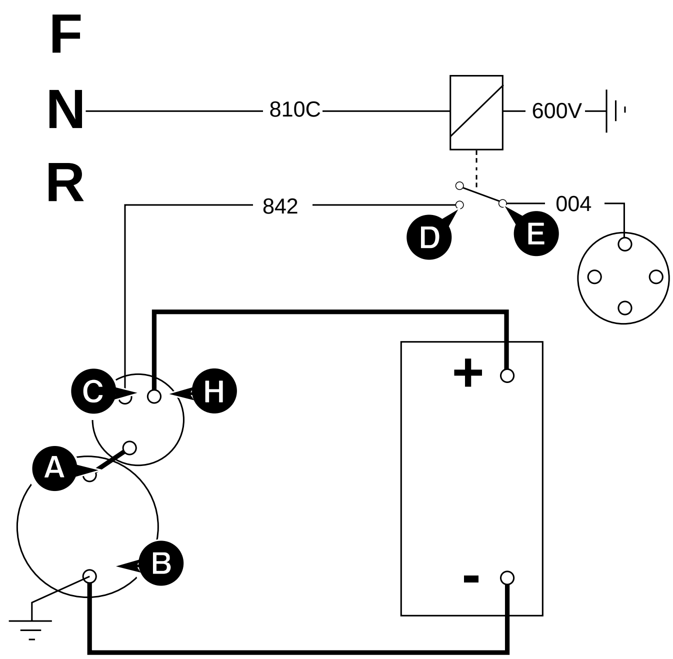
Connect the voltmeter between the solenoid terminal **C** and a good earth. Minimum permissible reading in 'start' position: 8.0V.



S151010

Test 3a

If the reading is less than specified, connect the voltmeter between the neutral start relay terminal **D** and earth. An increase in reading to 8.0V indicates a fault in the wiring from the start relay to the solenoid.



A215660

Starter Motor (cont’d)

Starting Circuit Test (cont'd)

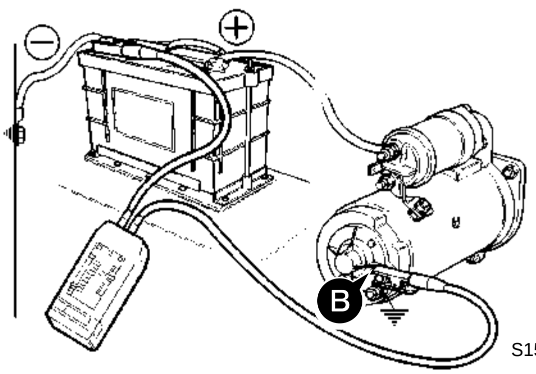
Test 3b

If the reading between terminal **D** and earth is below 8.0V, connect the voltmeter between terminal **E** and earth. An increase in the reading to 8.0V indicates either a faulty start relay or a fault in the feed from the transmission selector switch to the relay solenoid. Check also the solenoid earth connection.

If the reading between **E** and earth is less than 8.0V, the fault must be in either the starter switch or in the wiring between the solenoid, starter switch, and the start relay.

Test 4

Connect the voltmeter between battery negative and starter earth connection **B**. The reading in the 'start' position should be practically zero, maximum permissible reading 0.25V.

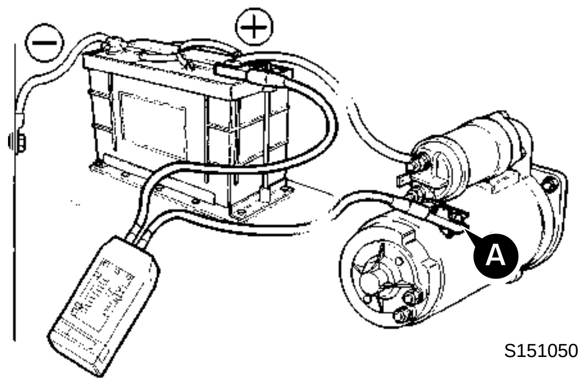


S151040

If the reading is above 0.25V, a high resistance in the earth lead or connections is indicated.

Test 5

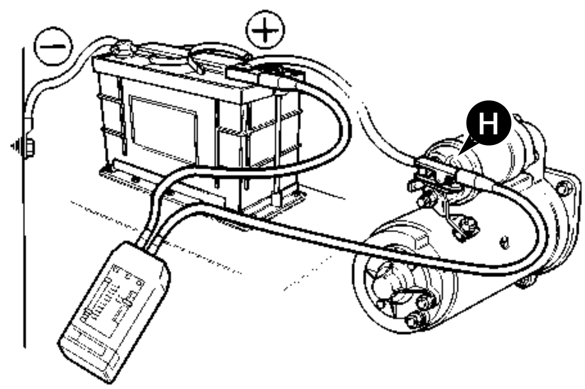
Connect the voltmeter between battery positive and the starter main terminal **A**. With the starter switch 'off', the voltmeter should indicate battery voltage, but it should fall to practically zero when the switch is turned to the 'on' position, maximum permissible reading 0.25V.



S151050

Test 5a

If the reading is above 0.25V, a high resistance is present in the insulated lead or in the solenoid. Connect the voltmeter between the battery positive and solenoid connection **H**. If the voltmeter now reads zero with the switch closed, the fault is in the solenoid.



Finally refit the engine stop fuse.

Wiring Harness

Introduction

Instances do occur where it is necessary to incorporate auxiliary electrical components into existing electrical circuits and, although unlikely with present wiring harnesses, repair or replace specific individual wires within a harness. This will also apply to other machines in addition to those of JCB manufacture.

To ensure that either the inclusion of an auxiliary electrical component or a repair within a harness is completed to an acceptable standard it is strongly recommended that the following tools, equipment and procedures are always used. Note that JCB harnesses have an International Protection rating of 67 (I.P.67).

The sheath covering of the recommended splice is heat shrunk onto the original wire insulation. This results in a seal and corresponding joint to IP 67 specifications.

⚠ CAUTION

When installing Auxiliary Electrical Components always ensure that the additional load rating is suitable for that particular circuit. It is unacceptable to simply increase the fuse rating as this can cause overloading and consequential failure of wiring, along with failure of integral circuit components, which the fuse is protecting.

ELEC 2 - 1

⚠ WARNING

In addition to the warnings incorporated into the procedure, extreme care should be taken when handling the gas heating tool to ensure that the flame does not damage or set fire to any items in the vicinity of the repair, i.e. other wires, floor panels, floor mats, sound proofing, paintwork. etc. This tool should not be used in any restricted location prohibiting the use of "Naked Flames' or where risk of explosive gas or similar safety parameters apply. No other heat source should be used to attempt a sealed joint .

ELEC 2 - 2

⚠ CAUTION

When the heater is in use, the reflector and the air coming out are extremely hot. Keep away to avoid accidental burns. Do not touch the reflector until it has had time to cool down after switching off. If flame reappears at the reflector when the heater is in use, the catalytic element is damaged or used up. Stop work immediately and replace the heater.

ELEC 2-3

Tools Required

892/00350	Butane Heater assembly	1
892/00349	Crimp tool	1
892/00351	Splice 0.5-1.5 mm (Red)	50
892/00352	Splice 1.5-2.5 mm (Blue)	50
892/00353	Splice 3.0-6.0 mm (Yellow)	50

Repair Procedure

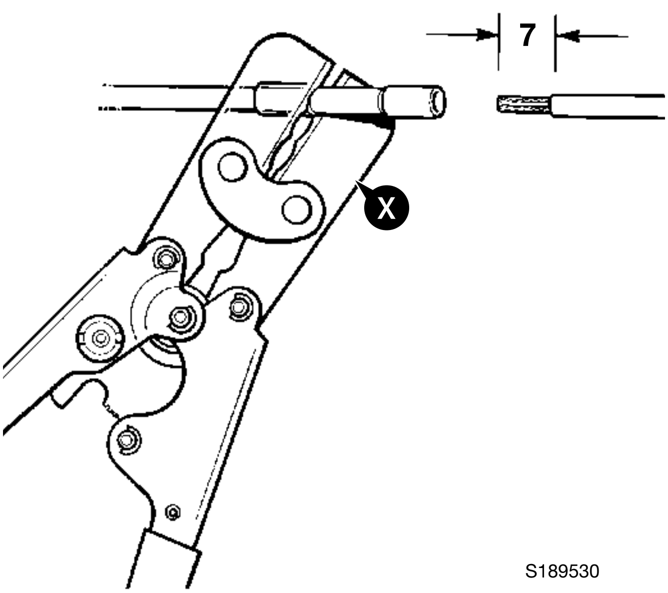
1 Cut the wire and remove the protective insulation for a suitable distance dependent upon the size of wire and splice to be used. For the splices detailed above, the dimension is 7mm.

2 Using the correct sized splice, attach the new section of wire required or auxiliary flying lead to the existing harness and secure using the crimp tool **X**, part number 892/00349.

Note that each of the splices detailed is colour-coded to make size and range readily visible. They are secured using the corresponding size and matching colour-coded jaws of the crimp tool to ensure joint security. This tool also incorporates a ratchet closing mechanism which will not release until the splice is fully closed to the correct compression size.

3 With the Butane heater assembly, 892/00350, seal the connection using the procedure on the next page.

....continued

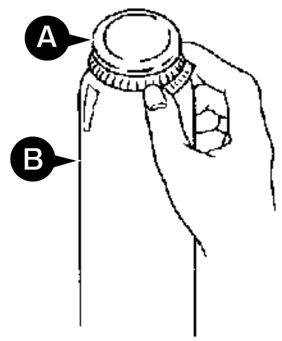


S189530

Wiring Harness - Repair Procedure (cont'd)

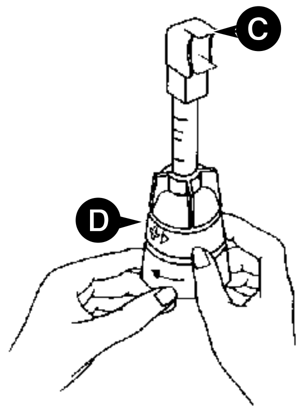
With the Butane Heater assembly 892/00350, seal the connection using the following procedure.

a Remove the cap **A** from the end of the disposable gas cartridge **B**.



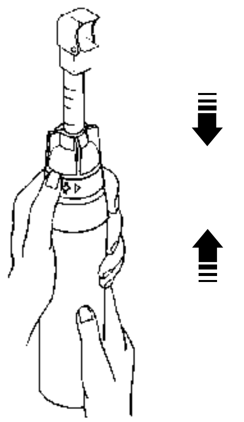
S189490/1

b Before assembling the gas cartridge to the reflector element **C**, turn the red ring **D** to the left, (in the direction of the minus sign marked on the ring).

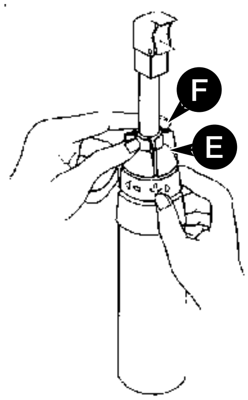


S189490/2

c Position the tube hanging down from inside the reflector assembly into the hole at the top of the gas cartridge. Then press the gas cartridge up into the reflector assembly as far as possible until the two elements are clasped firmly together. A click will be heard.


S189490/3

d Turn the small ring **E** so that the air holes at **F** are completely closed.

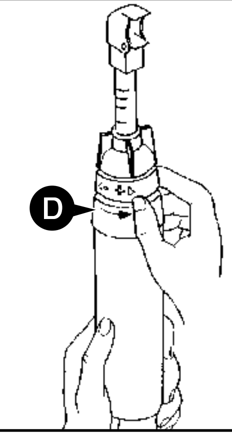


S189490/4

Wiring Harness - Repair Procedure (cont'd)

e Turn the red ring **D** to the right (in the direction of the plus sign) in order to turn on the gas.

IMPORTANT: Before turning the heater on, make sure that the cartridge is not hotter than the reflector element. This may occur if the cartridge is held in the hand for a long time. The temperature difference between the cartridge and the reflector element may cause long yellow flames to appear on ignition.

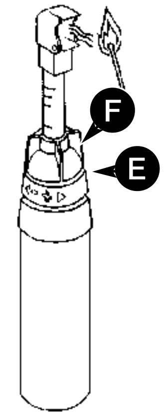


S189490/5

f Hold the heater vertically and, using a match or cigarette lighter, light the gas as shown.

Note: The fact that the sound of liquid cannot be heard when the cartridge is shaken does not mean it is empty. No sound will be heard even when the cartridge is full.

Hold the heater vertically for 1 to 2 minutes until the catalytic reaction occurs. This is indicated when the blue flame fades and the ceramic element glows red. Then turn the small ring **E** until the air holes at **F** are completely open. The tool is ready for use.



S189490/6

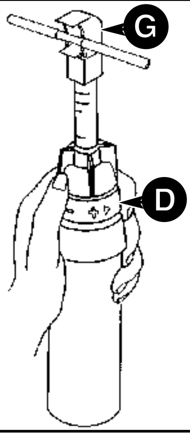
The heater can be used in two modes:

g Side wings **G** down, reflector head completely open. In this mode the infra-red heat waves are dominant (recommended for the light coloured plastic splices).

Side wings **G** up (see fig at step **h**), reflector head opening reduced. In this mode the heating is done only by the hot gas (use for dark coloured plastic splices).

S189490/7

h To switch off the heater, turn the red ring **D** to the left (in the direction of the minus sign).



S189490/8

Removal and Replacement

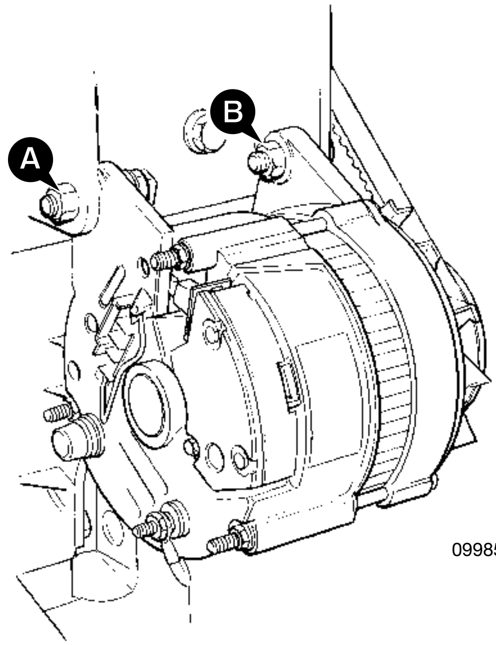
1 Disconnect the battery.

2 Remove the fan guard, if fitted.

3 Disconnect cables from rear of alternator, remove bolts **A**, **B** and **C** and withdraw unit from machine.

Replace by reversing the removal sequence.

Note: Position the alternator until belt deflection **W** is approximately 10 mm (3/8 in) before tightening bolts **B** and **C**. It may be necessary to slacken bolt **D** to allow full movement of alternator. Tighten bolt **A** last of all.



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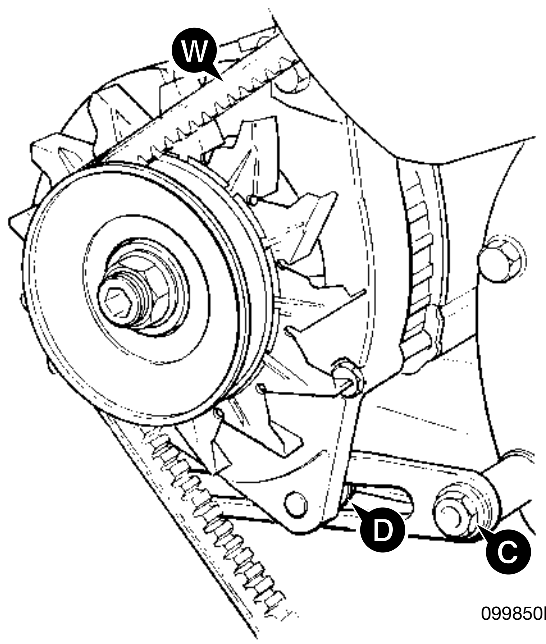

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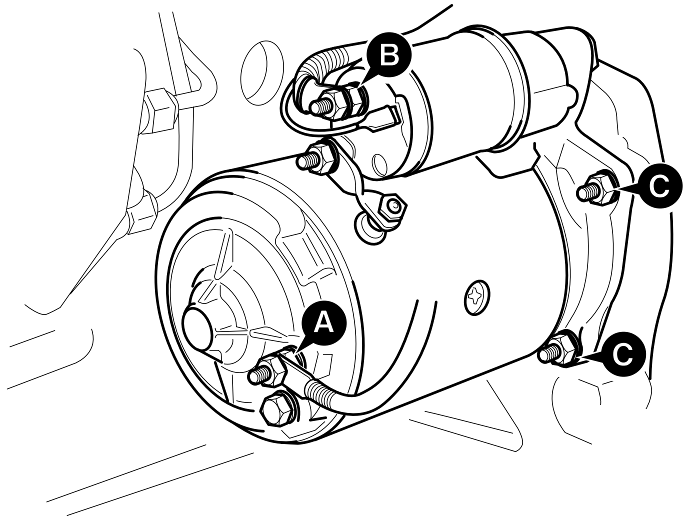
Removal and Replacement

1 Disconnect cables and remove battery.

2 Remove cables from main starter terminal **A** and solenoid terminal **B**.

3 Using special tool 825/00410 (and adapter 825/99833 if required) unscrew three securing nuts **C** and remove starter motor.

Replace by reversing the removal sequence.



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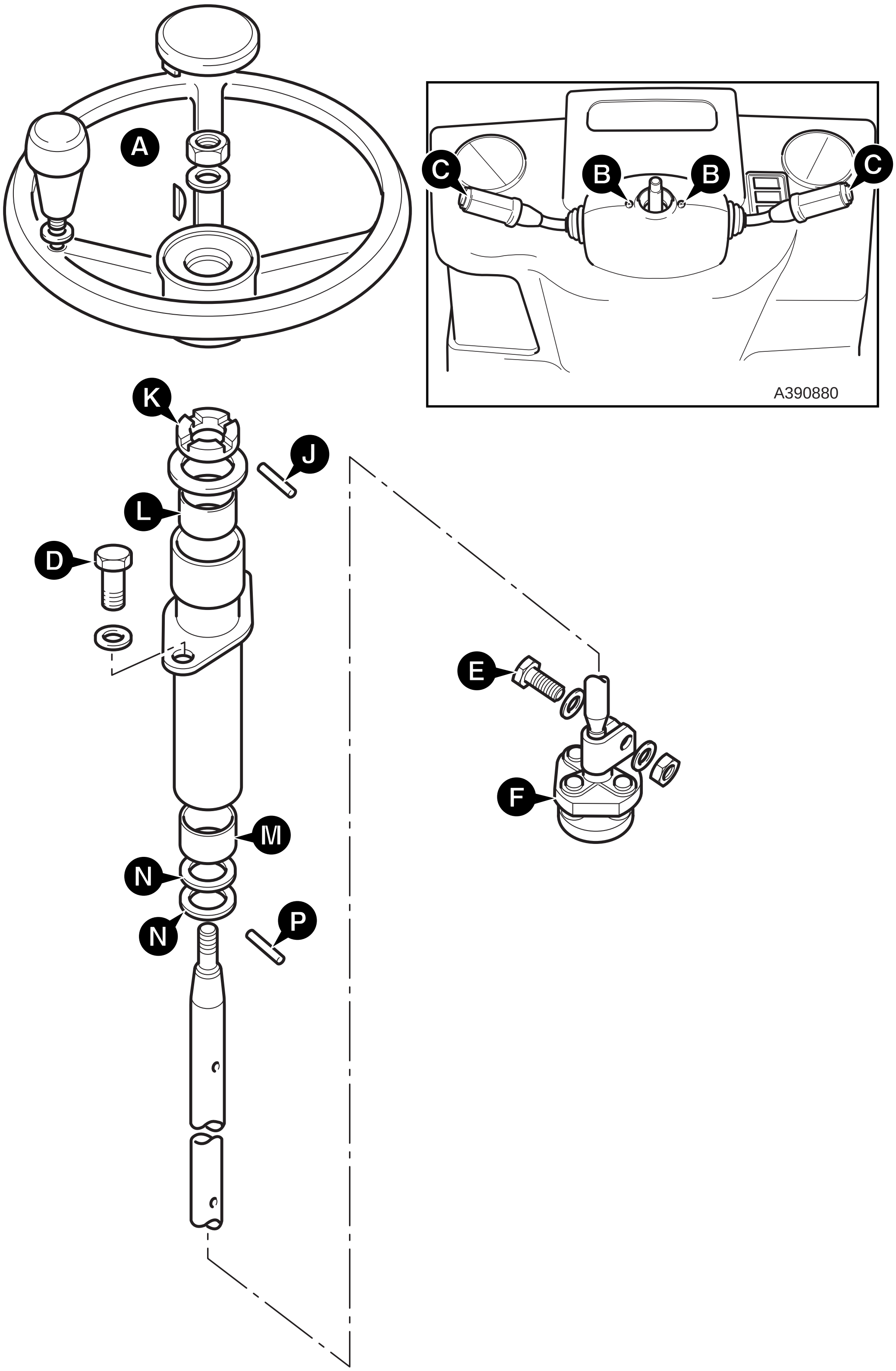


A390860

Removal and Replacement

The illustration on the adjacent page is intended as a guide to removal and replacement.

Removal

1 Remove the steering wheel as shown at **A**.

2 Remove screws **B** and take off the steering column cover.

3 Remove the control column switches **C**.

4 Remove bolts **D** and the coupling bolt **E**. Then carefully withdraw the steering column assembly from the flexible coupling **F**.

Replacement

Replacement is the reverse of the removal sequence.

Note: The coupling bolt **E** must engage with the cut-out in the shaft.

Dismantling and Assembly

The illustration on the adjacent page is intended as a guide to dismantling and assembly.

Dismantling

1 Remove set pin **J** and spacer **K** and withdraw shaft from the outer column assembly.

2 Bend back retaining tabs to remove upper bearing **L,** then remove lower bearing **M**.

Note: The top and bottom bearings **L** and **M** housed in the outer column assembly are non serviceable parts. They may be removed for cleaning and inspection, but if the bearing(s) have failed a new outer column assembly must be used.

Assembly

Assembly is the reverse of the dismantling sequence.

1 Press in bearing **M** until flush with the end of the outer column, and bearing **L** until it can be secured by the retaining tabs.

2 Assemble the shaft into the outer column assembly to achieve minimum end float (maximum permissible 2.0 mm (0.08 in)) by selecting an appropriate groove in spacer **K**.

Note: Fit additional spacing washers **N** above set pin **P** if necessary.

The loader control knob houses a microswitch which energises the transmission dump solenoid.

Make sure that all electrical connections are clearly labelled before removing the microswitch.

Dismantling and Assembly

The numerical sequence shown on the illustration is intended as a guide to dismantling.

For assembly the sequence should be reversed.

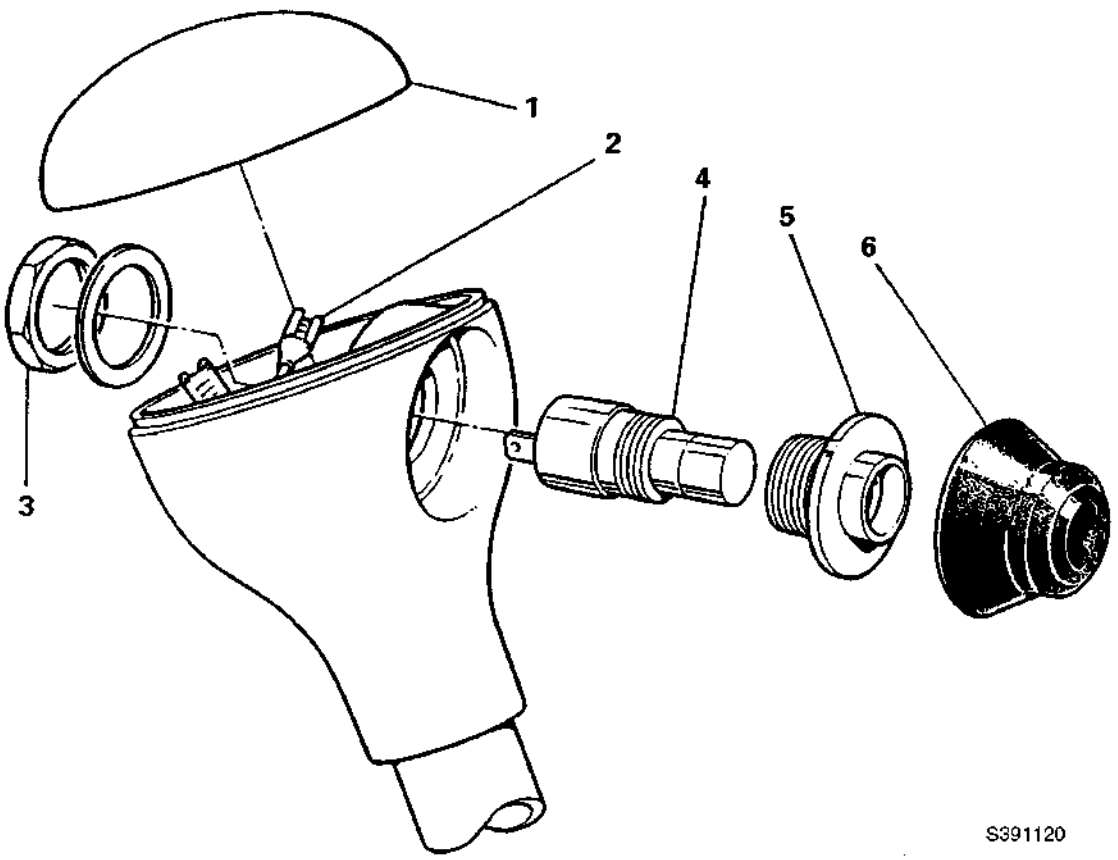
Dismantling

To gain access to the microswitch gently prise off top cover **1**. Disconnect wiring harness **2**, remove locknut **3** and shakeproof washer. Microswitch **4**, adapter **5**, and rubber cover **6** may now be withdrawn through the knob.

Assembly

Apply JCB Threadlocker and Sealer to microswitch adapter **5** prior to assembly.

Note: Microswitch **4** is a non-service item, and must be replaced as an assembly.



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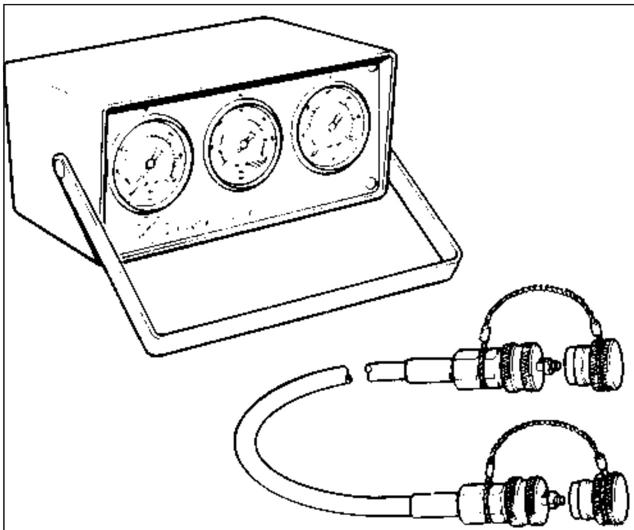


Hydraulic Circuit Pressure Test Kit

892/00253 Pressure Test Kit

892/00201 Replacement Gauge 0-20 bar (0-300 lbf/in^2)

892/00202 Replacement Gauge 0-40 bar (0-600 lbf/in^2)

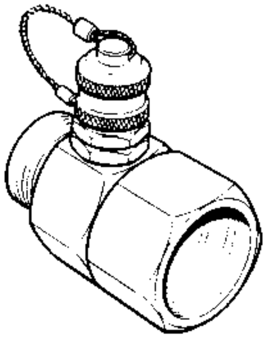
892/00203 Replacement Gauge 0-400 bar (0-6000 lbf/in^2)

892/00254 Replacement Hose

892/00347 Gauge Connector

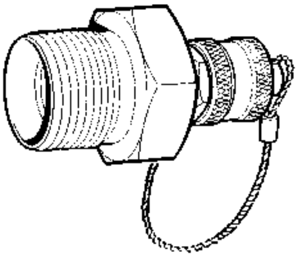
S188120

S188130



Pressure Test 'T' Adapters

892/00262	1/4 in M BSP x 1/4 in F BSP x Test Point
816/55038	3/8 in M BSP x 3/8 in F BSP x Test Point
816/55040	1/2 in M BSP x 1/2 in F BSP x Test Point
892/00263	5/8 in M BSP x 5/8 in F BSP x Test Point
892/00264	3/4 in M BSP x 3/4 in F BSP x Test Point
892/00265	1 in M BSP x 1 in F BSP x Test Point



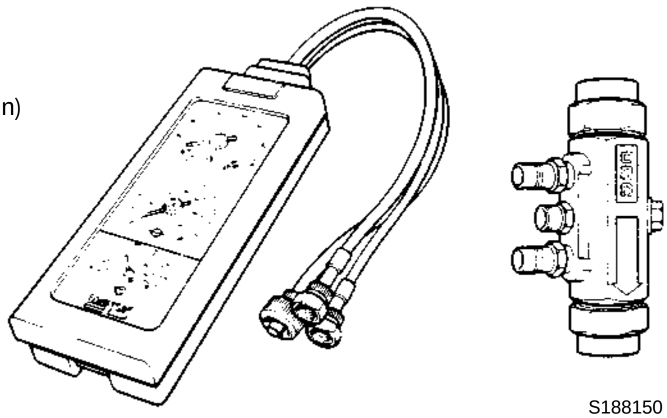
Pressure Test Adapters

892/00255	1/4 in BSP x Test Point
892/00256	3/8 in BSP x Test Point
892/00257	1/2 in BSP x Test Point
892/00258	5/8 in BSP x Test Point
816/15118	3/4 in BSP x Test Point
892/00259	1 in BSP x Test Point
892/00260	1.1/4 in BSP x Test Point
892/00261	5/8 in UNF x Test Point

S200140

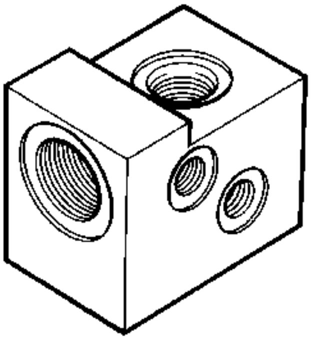
Flow Test Equipment

892/00268	Flow Monitoring Unit
892/00269	Sensor Head 0 - 100 l/min (0 - 22 UK gal/min)
892/00270	Load Valve
1406/0021	Bonded Washer
1604/0006	Adapter 3/4 in M x 3/4 in M BSP
1612/0006	Adapter 3/4 in F x 3/4 in M BSP
892/00271	Adapter 3/4 in F x 5/8 in M BSP
892/00272	Adapter 5/8 in F x 3/4 in M BSP
816/20008	Adapter 3/4 in F x 1/2 in M BSP
892/00275	Adapter 1/2 in F x 3/4 in M BSP
892/00276	Adapter 3/4 in F x 3/8 in M BSP
892/00277	Adapter 3/8 in F x 3/4 in M BSP



S188150

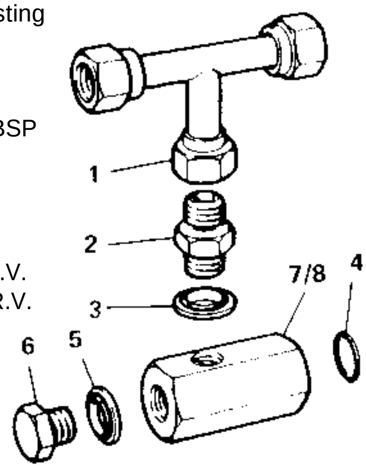
892/00252 Test Block for A.R.V.



S220840

Tool Components for Hamworthy A.R.V. testing

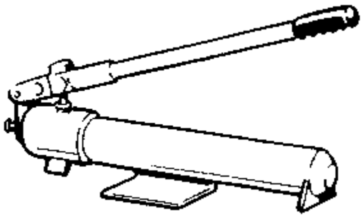
1	992/02400	Tee-piece
2	1606/0003	Adapter 3/8 in. x 1/4 in. BSP
3	1406/0011	Bonded Washer
4	2401/0103	'O' Ring
5	1406/0018	Bonded Washer
6	992/01003	Plug
7	992/10200	Body for Hamworthy A.R.V.
8	892/00153	Test Block Excavator A.R.V.



S230730

Hand Pump Equipment

892/00223	Hand Pump
892/00137	Micro-bore Hose 1/4 in BSP x 5 metres
892/00274	Adapter 1/4 in M BSP x 3/8 in M BSP Taper
892/00262	1/4 in M BSP x 1/4 in F BSP x Test Point
892/00706	Test Probe
892/00278	Gauge 0 - 40 bar (0 - 600 lbf/in^2)
892/00279	Gauge 0 - 400 bar (0 - 6000 lbf/in^2)



S193850

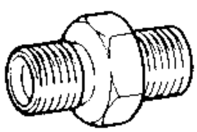
S188140

Bonded Washers

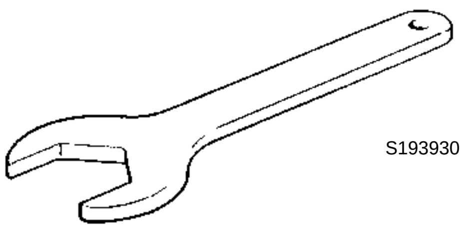
1406/0011	1/4 in BSP
1406/0018	1/2 in BSP
1406/0021	3/4 in BSP
1406/0029	1.1/4 in BSP

Male Adapters - BSP x BSP

1606/0003	3/8 in x 1/4 in
1604/0003	3/8 in x 3/8 in
1606/0004	1/2 in x 1/4 in
1606/0007	1/2 in x 3/8 in
1604/0004	1/2 in x 1/2 in
1606/0008	3/4 in x 3/8 in
1606/0009	3/4 in x 1/2 in
1604/0006	3/4 in x 3/4 in



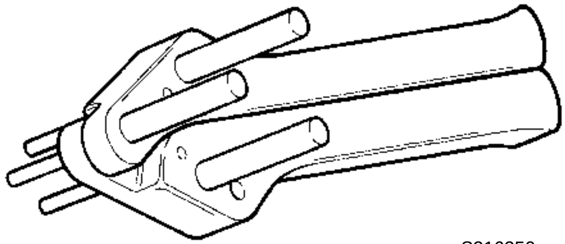
S193860



S193930

Hexagon Spanners for Ram Pistons and End Caps

992/10800	50 mm A/F
992/09300	55 mm A/F
992/09400	65 mm A/F

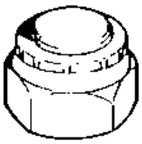


S216250

892/003334 Ram Seal Fitting Tool

Male Cone Blanking Cap

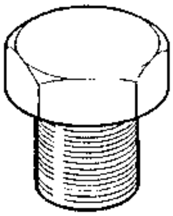
816/00294	1/4 in BSP
816/00189	3/8 in BSP
816/00190	1/2 in BSP
816/00197	5/8 in BSP
816/00196	3/4 in BSP
816/00193	1 in BSP



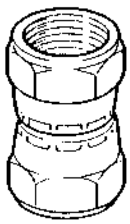
S193880

Female Cone Blanking Plug

892/00055	1/4 in BSP
892/00056	3/8 in BSP
892/00057	1/2 in BSP
892/00059	3/4 in BSP
892/00060	1 in BSP



S193870



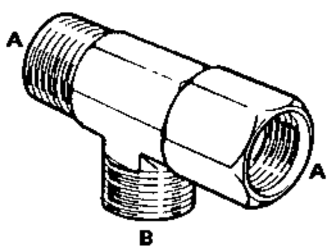
S193900

Female Connectors

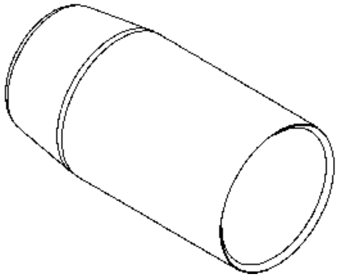
892/00074	3/8 in BSP x 3/8 in BSP
892/00075	1/2 in BSP x 1/2 in BSP
892/00077	3/4 in BSP x 3/4 in BSP

'T' Adapters

892/00047	3/8 in BSP (A) x 1/4 in BSP (B)
892/00048	1/2 in BSP (A) x 1/4 in BSP (B)
816/50043	3/4 in BSP (A) x 1/4 in BSP (B)
816/60096	3/4 in BSP (A) x 3/4 in BSP (B)



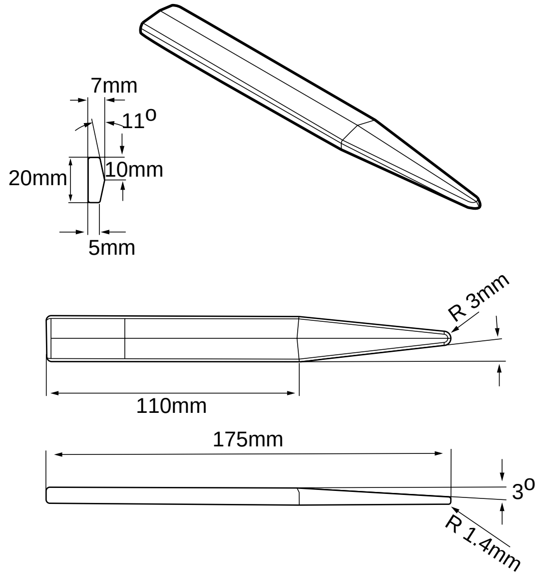
S193890


S338410

Ram Seal Protection Sleeves

892/01016	For 25 mm Rod Diameter
892/01017	For 30 mm Rod Diameter
892/01018	For 40 mm Rod Diameter
892/01019	For 50 mm Rod Diameter
892/01020	For 50 mm Rod Diameter
892/01021	For 60 mm Rod Diameter
892/01022	For 60 mm Rod Diameter
892/01023	For 65 mm Rod Diameter
892/01024	For 70 mm Rod Diameter
892/01025	For 75 mm Rod Diameter
892/01026	For 80 mm Rod Diameter
892/00167	For 90 mm Rod Diameter

892/01027 Piston Seal Assembly Tool



338500

System Type

An engine driven gear pump provides a fixed flow output to supply the steering, loader and excavator hydraulic circuits. This is supplemented by an auxiliary gear pump on some machine configurations where additional flow is required.

Main Hydraulic Pump

Model/Reference	Single/67910		
Rotation	Clockwise		
Mounting	Engine Timing Case		
Flow at 2000 rev/min and system pressure	**litres/min**	**UK gal/min**	**US gal/min**
	72	15.84	19.02

Auxiliary Hydraulic Pump (if fitted)

Model/Reference	Single/4240J		
Rotation	Anti-Clockwise		
Mounting	Auxiliary Take-Off		
Flow at 2000 rev/min and system pressure	**litres/min**	**UK gal/min**	**US gal/min**
	28	6.16	7.39

Relief Valve Operating Pressures	**bar**	**kgf/cm^2**	**lbf/in^2**
Main Relief Valve (M.R.V.)	227	232	3300
Auxiliary Relief Valves (A.R.V.)			
Loader			
Shovel Ram Head Side (pilot-operated)	241	246	3500
Shovel Ram Rod Side (pilot-operated)	275	281	4000
Auxiliary Ram Head Side (direct acting)	241	246	3500
Auxiliary Ram Rod Side (direct acting)	241	246	3500
Excavator			
Slew Ram Head Side	262	267	3800
Slew Ram Rod Side	262	267	3800
Boom Ram Head Side	248	253	3600
Boom Ram Rod Side	316	267	4495
Dipper Ram Head Side	248	253	3600
Dipper Ram Rod Side	248	253	3600
Bucket Ram Head Side	248	253	3600
Hydraulic Tool Circuit (HTC) (if fitted)	138	141	2000

Return Line Filter	**bar**	**kgf/cm^2**	**lbf/in^2**
By-pass pressure	1.72	1.76	25

Smooth Ride System

System Type

A piston type accumulator operates as a liquid spring absorbing displaced fluid from the lift rams. Selectable from a switch in the cab.

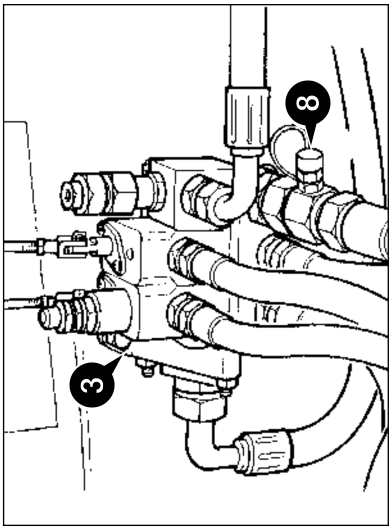
Charging Gas	Air Free Dry Nitrogen
Accumulator Capacity	1.0 litre (58 cu/in)
Accumulator Weight	4.4 kg (9.75 lb)

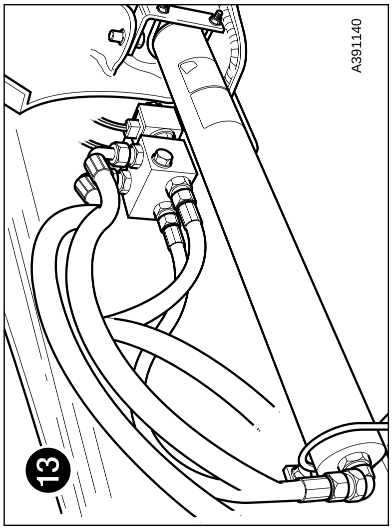
Accumulator Charge Pressure

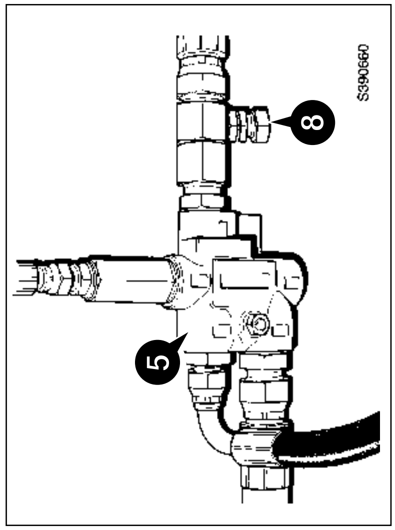
As a general guide for given shovel weights (loaded) see below:-

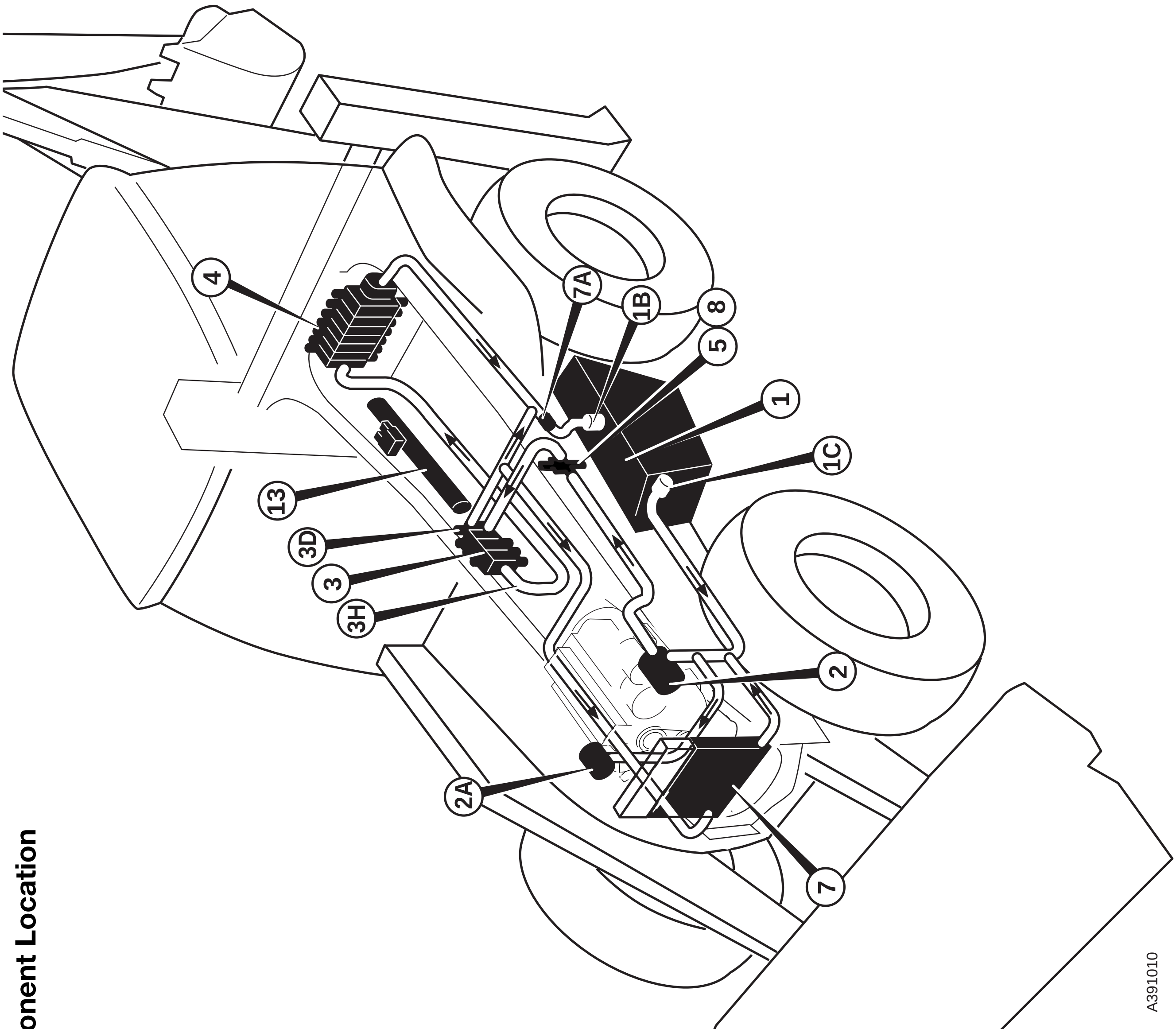
	bar	**kgf/cm^2**	**lbf/in^2**
Shovel weights up to 700 kg (1540 lb)	13.8	14	200
Shovel weights 700 kg to 950 kg (1540 - 2100 lb)	19	19.4	275
Shovel weights over 950 kg (2100 lb)	24	24.5	350

Note: Replacement accumulators will only be supplied in an uncharged, non pressureised condition to meet Health and Safety/Airfreight hazardous goods requirements.









Component Location

Component Location

Component Key:

1 Hydraulic Tank
1B Return Line Filter (inside hydraulic tank)
1C Suction Strainer (inside hydraulic tank)
2 Hydraulic Pump (engine driven)
2A Auxiliary Hydraulic Pump (engine driven) (if fitted)
3 Loader Valve Block
3D Main Relief Valve
3H Hose - High Pressure Cary Over
4 Excavator Valve
5 Steer Circuit Priority Valve
7 Hydraulic Oil Cooler
7A Return Line Check Valve
8 Pressure Test-point Connector
13 Smooth Ride Accumulator and Control Valves

Neutral Circuit Description

Oil is drawn through suction strainer **1C** from hydraulic tank **1** by the engine-driven single stage hydraulic gear pump **2**. From the pump, oil flows to the steering circuit and/or the loader valve block **3** by way of the priority valve **5**, which always gives priority to the steering circuit requirements.

A pressure test-point connector **8** is located in the pipe fitting adjacent to the priority valve **5**.

From the loader valve neutral gallery, oil flows via a high pressure carry-over line **3H** to the excavator valve **4**.

Some exhaust oil from the excavator and loader valves flows back direct to the tank and some through cooler **7.** Oil flowing back to tank passes through return line filter **1B** (mounted within the tank).

To help prevent excavator dipper ram and loader lift ram cavitation, there is a check valve **7A** fitted in the return line, which raises the return line pressure and improves the operation of the respective anti-cavitation valves.

Note: On some machine configurations an additional pump **2A** draws oil from tank **1** to supply an additional flow to the excavator valve **4**, which is required for certain machine options/attachments.

Introduction to Hydraulic Schematic Symbols

Complex hydraulic components and circuits can be described to the engineer by using graphical symbols. The following pages illustrate and give a brief description for some of the more common symbols used.

There are many symbols in use and it would be impossible to include them all here. However it should be noted that most are only variations or refinements on the basic principles explained here. If more detailed information is required you are recommended to obtain a copy of BS2917 or IS01219.

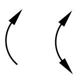
Once familiar with the symbols, the engineer can use hydraulic circuit diagrams as an aid to fault finding. It will be possible to see the complete hydraulic circuit and decipher the relationship between hydraulic components.

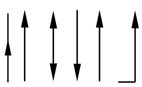
General (Basic & Functional Symbols)


Spring


Flow restriction
affected by viscosity


Direction of flow

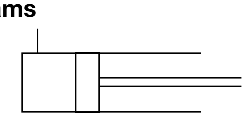

Indication of rotation

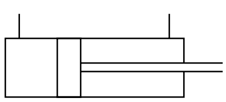

Indication of direction
and paths of flow

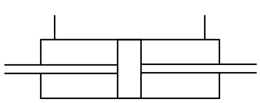

Variable control

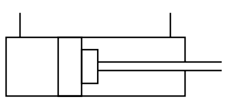
A189660

Rams


Single acting

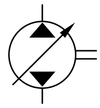

Double acting

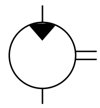

Double ended

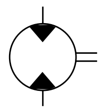

Double acting with
damping at rod area end

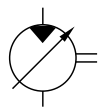
A189670

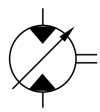
Pumps & Motors


Variable capacity pump
two directions of flow


Fixed capacity motor
one direction of flow


Fixed capacity motor
two directions of flow

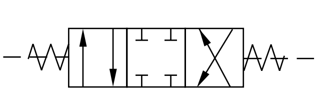

Variable capacity motor
one direction of flow


Variable capacity motor
two directions of flow

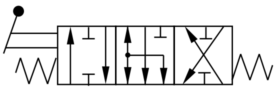
A189680

Introduction to Hydraulic Schematic Symbols (cont'd)

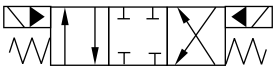
Control Valves



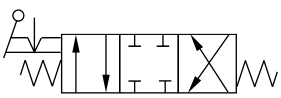
3-Position, 4-Port spring centred pilot operated valve



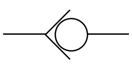
3-Position, 6-Port spring centred hand operated valve



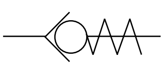
3-Position, 4-Port spring centred solenoid & pilot pressure operated valve



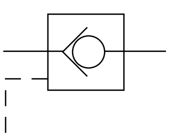
3-Position, 4-Port spring centred detent hand operated valve



Non - return valve

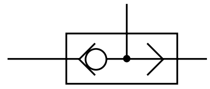


Non - return valve with back pressure spring

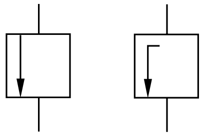


Pilot operated non - return valve

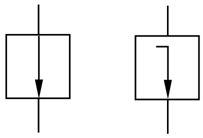
A189690



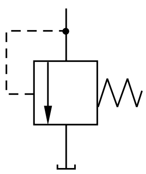
High pressure selector (shuttle valve)



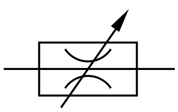
Throttling orifice - normally closed



Throttling orifice - normally open



Relief valve



Variable restrictor

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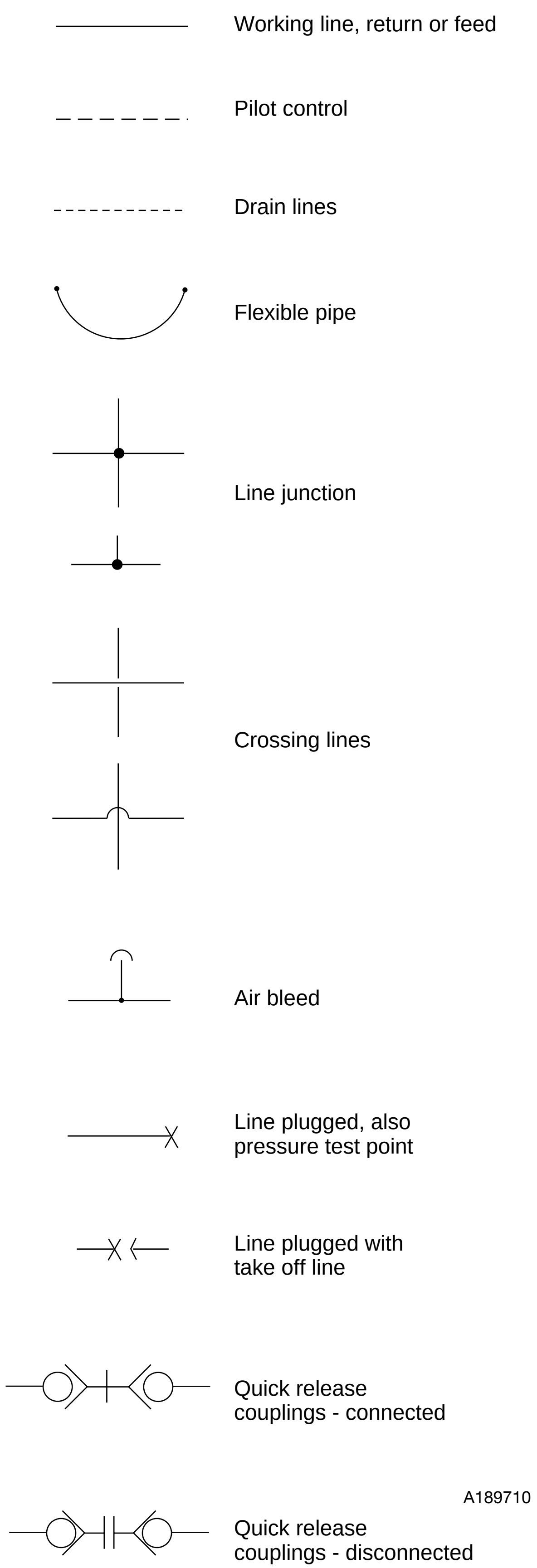
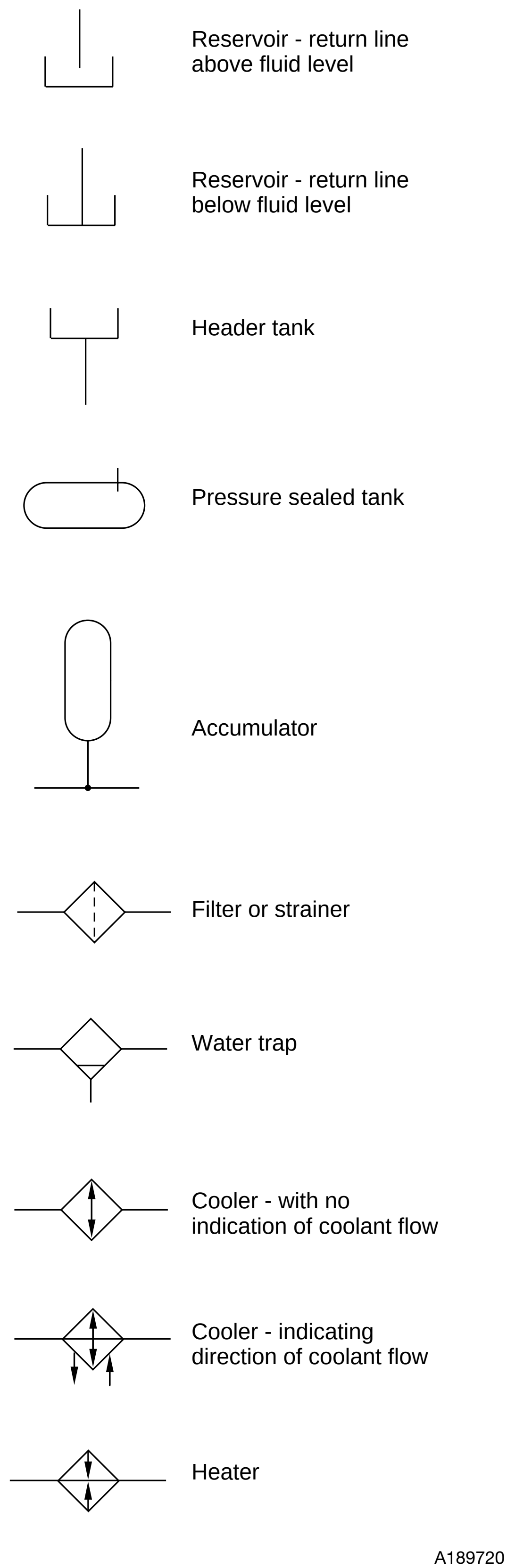
Introduction to Hydraulic Schematic Symbols (cont'd)

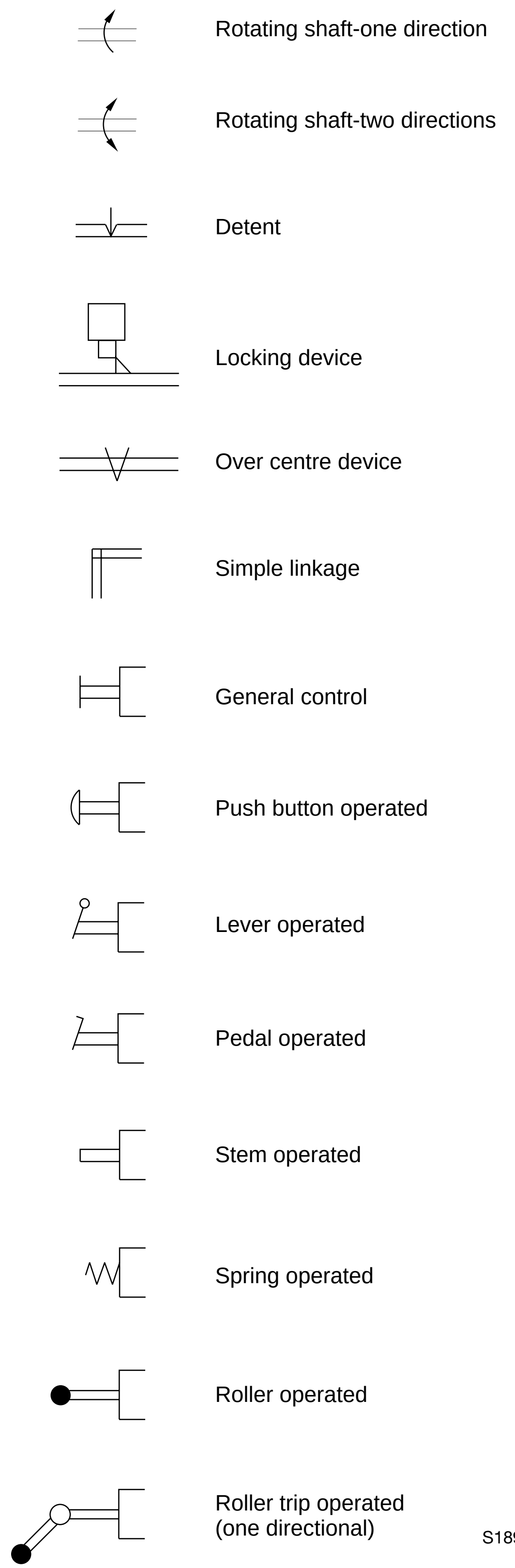
Energy Transmissions and Conditioning



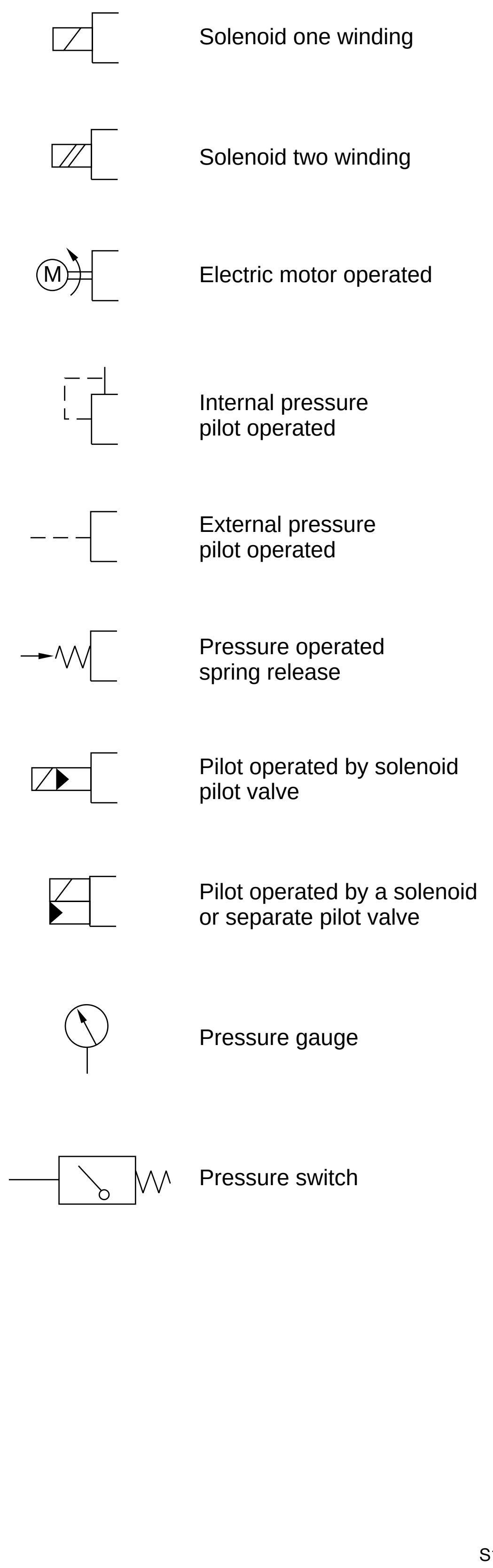


Introduction to Hydraulic Schematic Symbols (cont'd)

Control Mechanisms



S189730



S189740

Introduction to Hydraulic Schematic Symbols (cont'd)

Control Valves

Control valves are usually represented by one or more square boxes.

Fig. 1 shows a control valve represented by three boxes. The number of boxes indicates the number of possible valve operating positions, (4 boxes - 4 positions etc).

Fig. 2 - In circuit diagrams the pipework is usually shown connected to the box which represents the unoperated condition. (Hydraulic circuit diagrams are usually shown in the unoperated condition).

Fig. 3 shows a valve described as a 3- position, 4-port control valve. Port describes the openings to and from the valve by which the hydraulic fluid enters or leaves. In the fig shown, Position 2 indicates that in an unoperated condition all 4 ports are blocked.

If the valve spool was moved to Position 1, movement of the spool would connect Port 1 to Port 2, and Port 3 to Port 4.

If the valve spool was moved to Position 3, movement of the spool would connect Port 1 to Port 4, and Port 3 to Port 2.

It must be noted that not all spools are of the same type. Their operating designs can be seen by following the path the flow arrows take in their respective operating squares.

Three typical JCB style spools are known as 'D' spools, 'F' spools and 'N' spools.

The 'D' spools generally control rams because when in the neutral position the outlet ports are blocked, preventing ram movement. Fig 3 shows a 'D' type spool.

Fig 4 - 'F' spools are often shown as four position spools with the three normal positions for neutral and service control; and the forth position, which has a detent, connects both sides of the ram together to allow the service to 'float'.

Fig 5 - 'N' spools are sometimes used to control hydraulic motors, and it can be seen from the flow arrows, that in neutral position both service ports are connected to the exhaust oil port

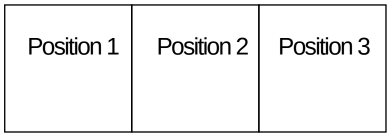


FIG 2

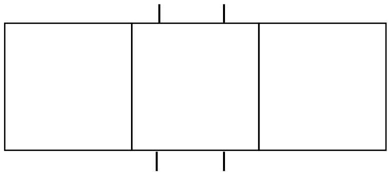


FIG 3

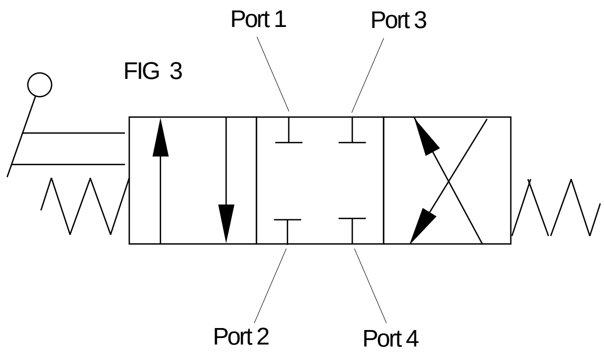


FIG 4

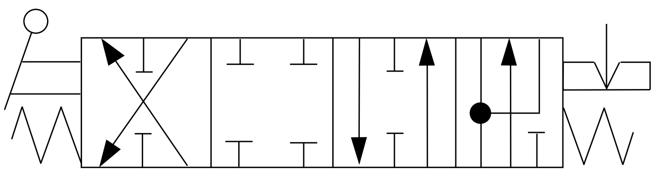
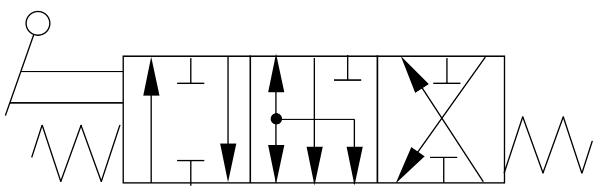


FIG 5



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Introduction to Hydraulic Schematic Symbols (cont'd)

Example of Schematic Circuit

Some of the symbols described on the preceding pages have been arranged into a simple schematic circuit shown below.

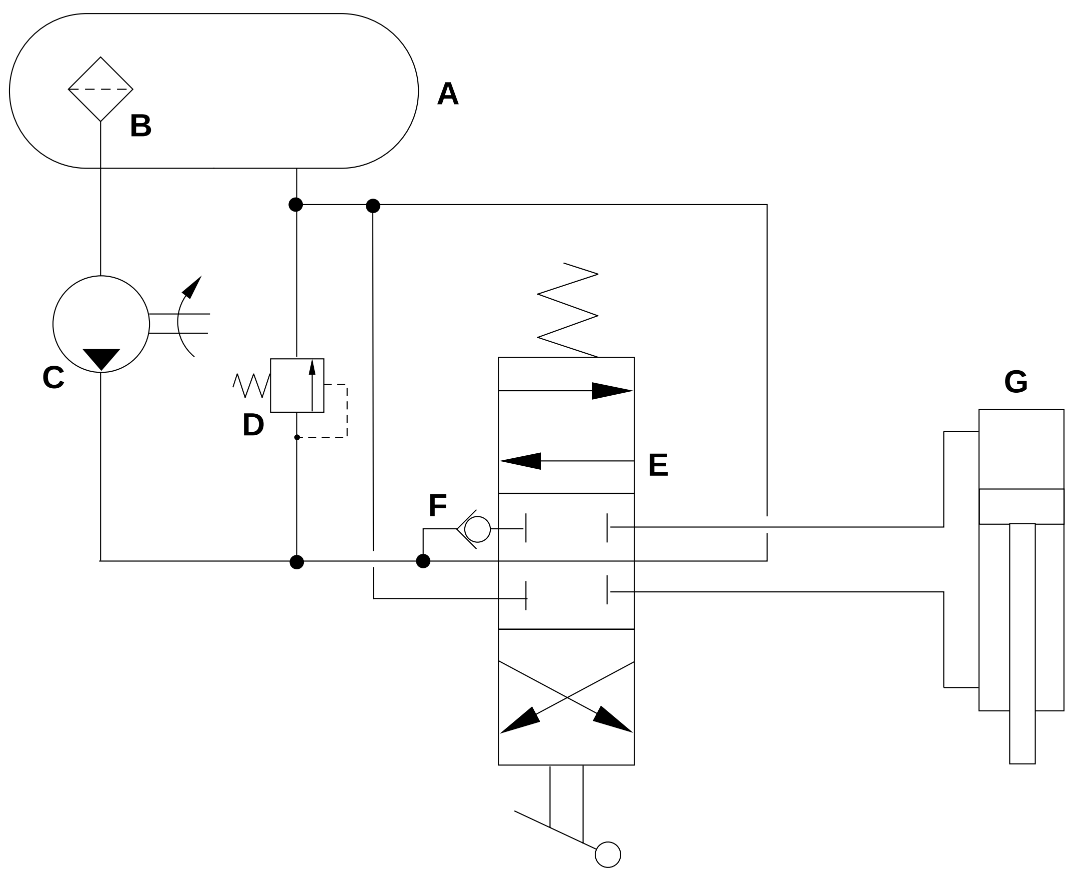
Hydraulic tank **A** is a pressurised tank with an internally mounted strainer **B** on the suction line to the fixed displacement pump **C**. System pressure is limited to the setting of relief valve **D**.

Valve spool **E** is an open-centre spool that is in neutral position; flow from the pump passes through the spool and returns to the hydraulic tank.

If the lever operated spool is moved away from neutral position hydraulic fluid is directed to either head side or rod side of hydraulic ram **G**. Notice that the fluid must first open one way valve **F** before flowing to the ram.

Example Circuit Key

A Hydraulic Tank
B Strainer
C Fixed Displacement Pump
D Relief Valve
E Spool
F One Way Valve
G Double Acting Hydraulic Ram



A189770

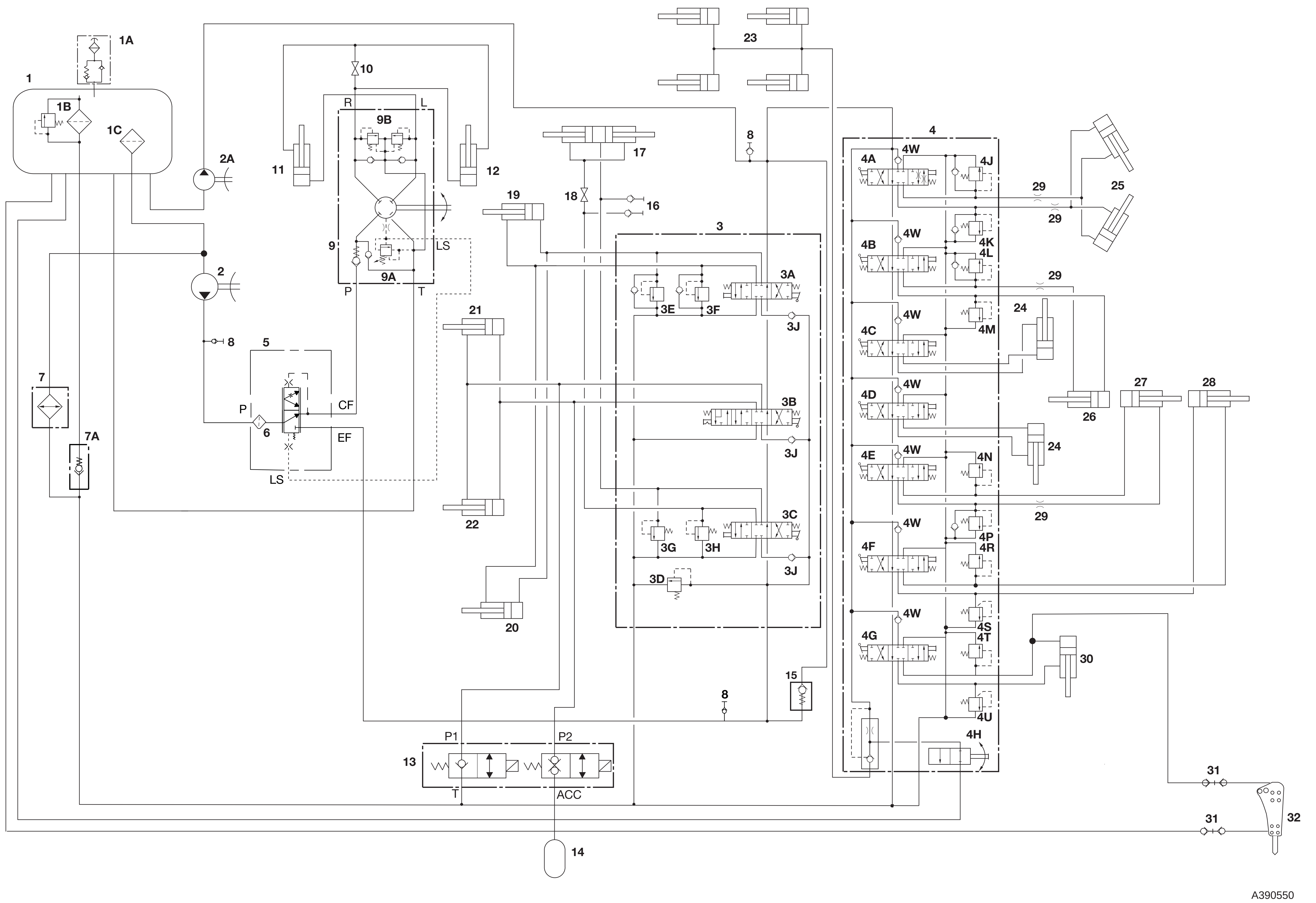
Hydraulic System Schematic

2CX, 210S

Component Key

1 Tank
1A Tank cap
1B Filter with bypass
1C Suction strainer
2 Main pump
2A Auxiliary pump (if fitted)
3 Loader valve block (2 or 3 spool)
3A Loader shovel spool
3B Loader lift spool with float
3C Auxiliary /Quick Hitch spool
3D Main relief valve
3E Shovel ram head side A.R.V.
3F Shovel ram rod side A.R.V.
3G Auxiliary /Quick Hitch ram head side A.R.V.
3H Auxiliary /Quick Hitch ram rod side A.R.V.
3J Load hold check valves
4 Excavator valve block
4A Slew spool
4B Boom spool
4C Stabiliser spool
4D Stabiliser spool
4E Dipper spool
4F Bucket spool
4G Auxiliary/Extending dipper spool
4H Hydraclamp valve
4J Slew left A.R.V.
4K Slew right A.R.V.
4L Boom ram rod side A.R.V.
4M Boom ram head side A.R.V.
4N Dipper ram head side A.R.V.
4P Dipper ram rod side A.R.V.
4R Bucket ram rod side A.R.V.
4S Bucket ram head side A.R.V.
4T Auxiliary/Extending dipper head side A.R.V.
4U Auxiliary/Extending dipper rod side A.R.V.
4W Load hold check valves
5 Priority valve
6 Filter gauze
7 Cooler
7A Check valve (5 bar)
8 Pressure test connectors
9 Steer unit
9A Steer relief valve
9B Steer shock valves
10 Steer setting valve
11 Rear steer ram
12 Front steer ram
13 Smooth ride selector valve
14 Accumulator
15 Check valve
16 Auxiliary attachment quick release couplings
17 Loader hydraulic quickhitch
18 Loader quickhitch locking valve
19 Shovel ram R.H.
20 Shovel ram L.H.
21 Lift ram R.H.
22 Lift ram L.H.
23 Hydraclamps
24 Stabiliser rams
25 Slew rams
26 Boom ram
27 Dipper ram
28 Bucket ram
29 Bi-restrictor
30 Auxiliary/Extending dipper ram
31 Rockbreaker quick release couplings
32 Rockbreaker

Note: Excavator services shown here are to the JCB 'X' control pattern. For ISO '+' control pattern, components 4B, 4L and 4M swap positions with items 4E, 4N and 4P respectively.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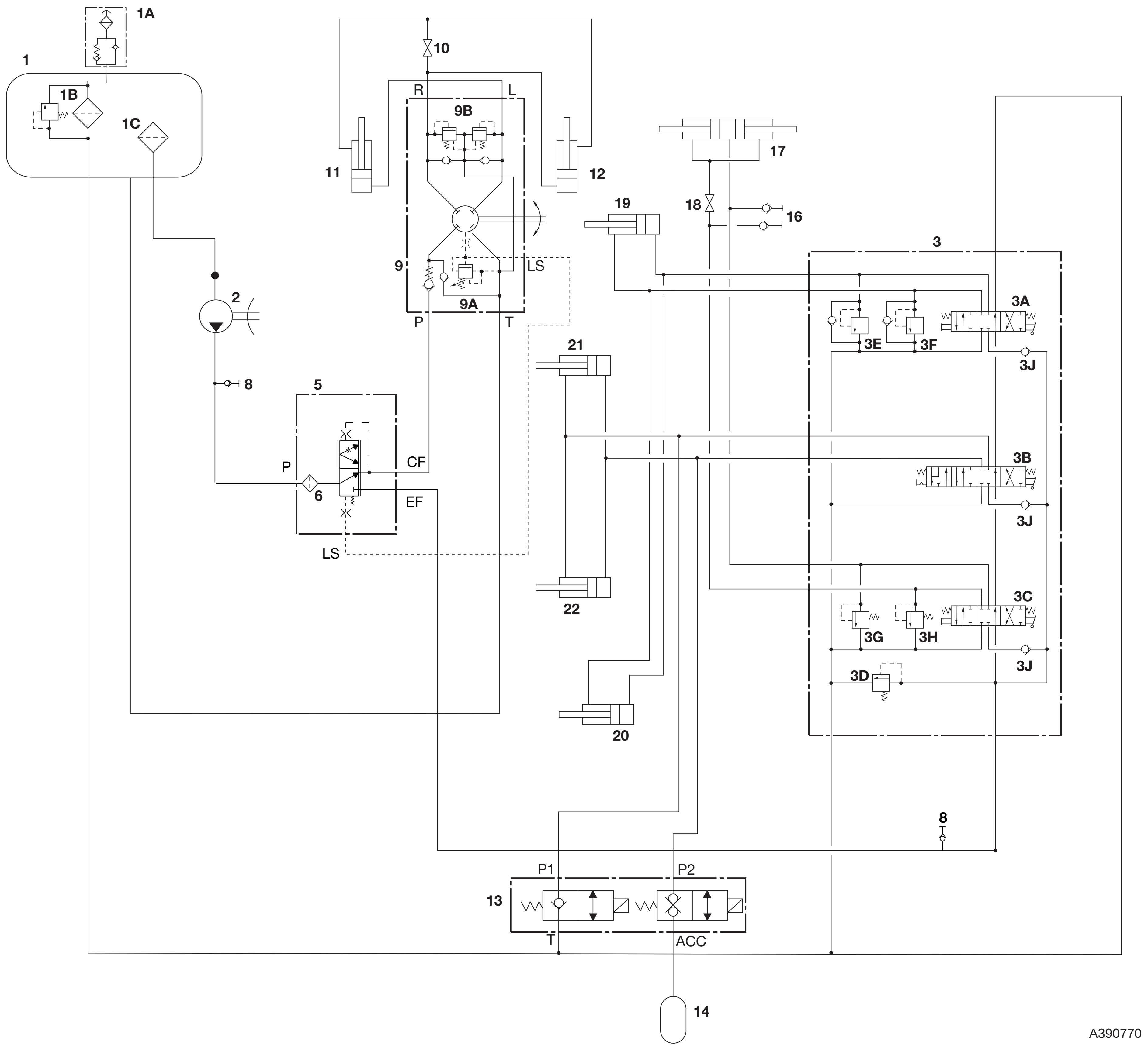
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Hydraulic System Schematic

2CX Airmaster

Component Key

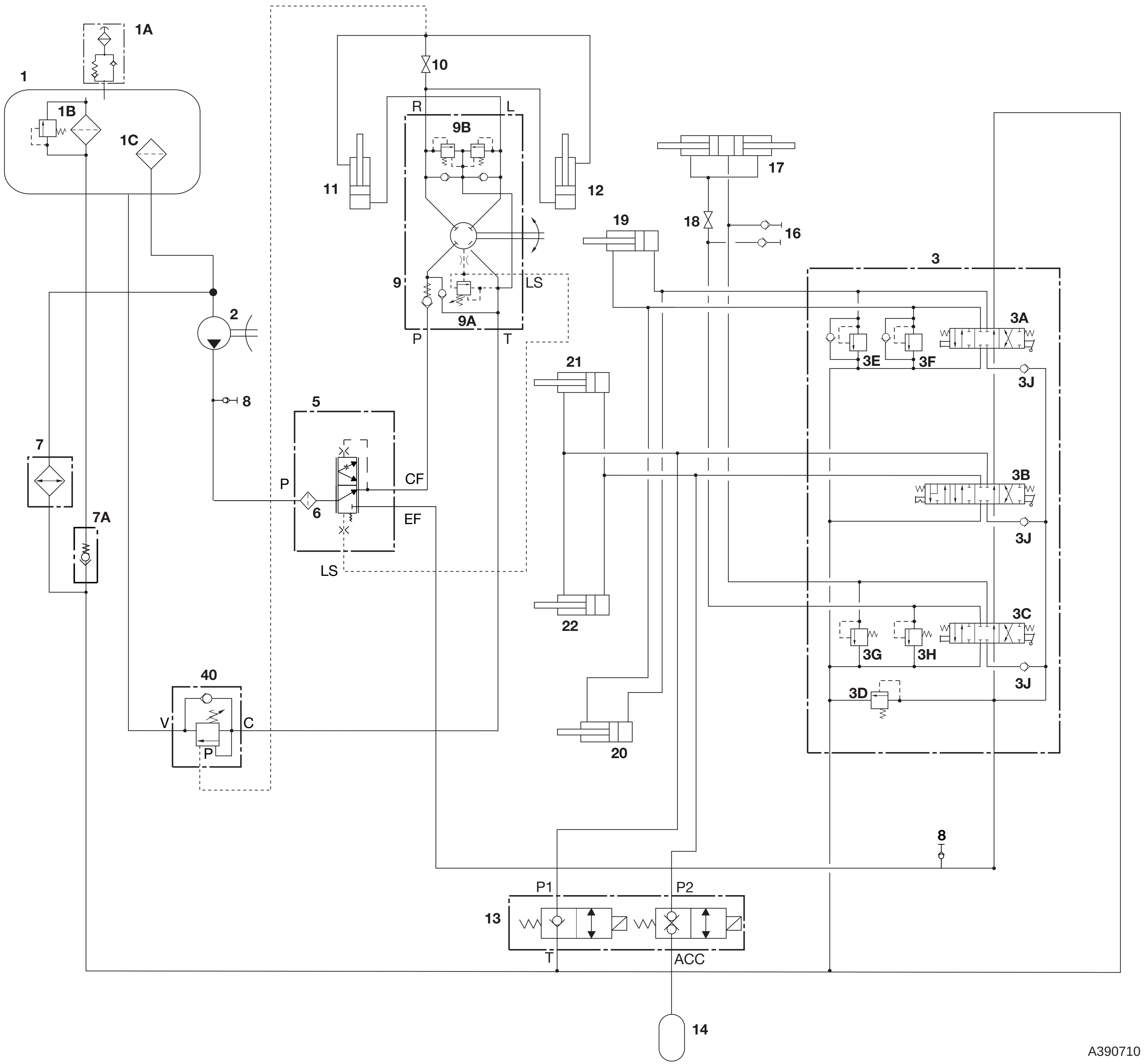
1	Tank
1A	Tank cap
1B	Filter with bypass
1C	Suction strainer
2	Main pump
3	Loader valve block (2 or 3 spool)
3A	Loader shovel spool
3B	Loader lift spool with float
3C	Auxiliary /Quick Hitch spool
3D	Main relief valve
3E	Shovel ram head side A.R.V.
3F	Shovel ram rod side A.R.V.
3G	Auxiliary /Quick Hitch ram head side A.R.V.
3H	Auxiliary /Quick Hitch ram rod side A.R.V.
3J	Load hold check valves
5	Priority valve
6	Filter gauze
8	Pressure test connectors
9	Steer unit
9A	Steer relief valve
9B	Steer shock valves
10	Steer setting valve
11	Rear steer ram
12	Front steer ram
13	Smooth ride selector valve
14	Accumulator
16	Auxiliary attachment quick release couplings
17	Loader hydraulic quickhitch
18	Loader quickhitch locking valve
19	Shovel ram R.H.
20	Shovel ram L.H.
21	Lift ram R.H.
22	Lift ram L.H.

Hydraulic System Schematic

2CX Farm Master

Component Key

1	Tank
1A	Tank cap
1B	Filter with bypass
1C	Suction strainer
2	Main pump
3	Loader valve block (2 or 3 spool)
3A	Loader shovel spool
3B	Loader lift spool with float
3C	Auxiliary /Quick Hitch spool
3D	Main relief valve
3E	Shovel ram head side A.R.V.
3F	Shovel ram rod side A.R.V.
3G	Auxiliary /Quick Hitch ram head side A.R.V.
3H	Auxiliary /Quick Hitch ram rod side A.R.V.
3J	Load hold check valves
5	Priority valve
6	Filter gauze
7	Cooler
7A	Check valve (5 bar)
8	Pressure test connectors
9	Steer unit
9A	Steer relief valve
9B	Steer shock valves
10	Steer setting valve
11	Rear steer ram
12	Front steer ram
13	Smooth ride selector valve
14	Accumulator
16	Auxiliary attachment quick release couplings
17	Loader hydraulic quickhitch
18	Loader quickhitch locking valve
19	Shovel ram R.H.
20	Shovel ram L.H.
21	Lift ram R.H.
22	Lift ram L.H.
40	Anti-cavitation valve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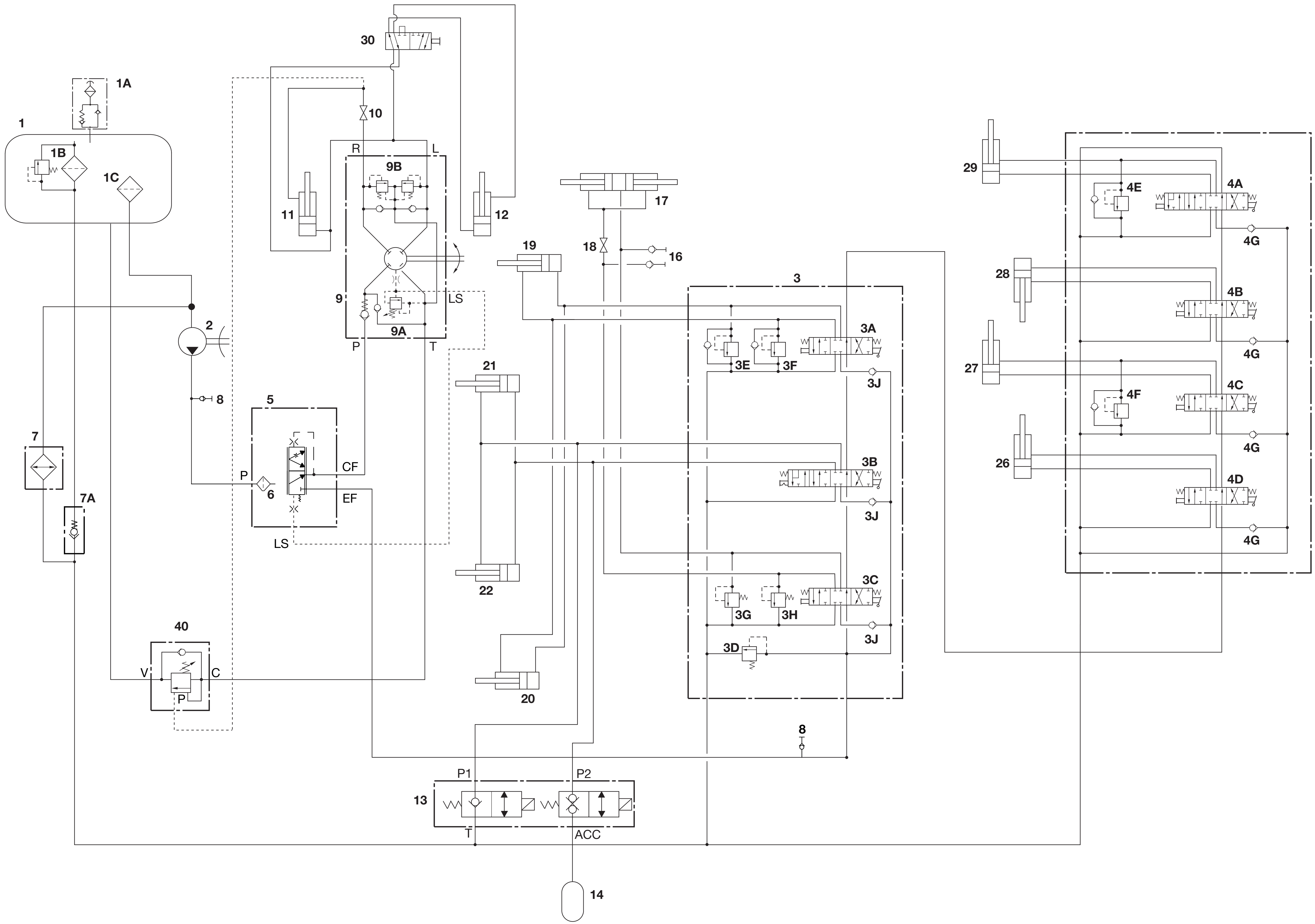
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A390720

Hydraulic System Schematic

2CXU, 212SU Utility

Component Key

1	Tank
1A	Tank cap
1B	Filter with bypass
1C	Suction strainer
2	Main pump
3	Loader valve block (2 or 3 spool)
3A	Loader shovel spool
3B	Loader lift spool with float
3C	Auxiliary /Quick Hitch spool
3D	Main relief valve
3E	Shovel ram head side A.R.V.
3F	Shovel ram rod side A.R.V.
3G	Auxiliary /Quick Hitch ram head side A.R.V.
3H	Auxiliary /Quick Hitch ram rod side A.R.V.
3J	Load hold check valves
4	3 point hitch valve block
4A	Lift/lower/float spool
4B	Pitch spool
4C	Tilt spool
4D	Auxiliary spool
4E	Lift A.R.V.
4F	Tilt A.R.V.
4G	Load hold check valves
5	Priority valve
6	Filter gauze
7	Cooler
7A	Check valve (5 bar)
8	Pressure test connectors
9	Steer unit
9A	Steer relief valve
9B	Steer shock valves
10	Steer setting valve
11	Rear steer ram
12	Front steer ram
13	Smooth ride selector valve
14	Accumulator
16	Auxiliary attachment quick release couplings
17	Loader hydraulic quickhitch
18	Loader quickhitch locking valve
19	Shovel ram R.H.
20	Shovel ram L.H.
21	Lift ram R.H.
22	Lift ram L.H.
26	Auxiliary ram
27	Tilt ram
28	Pitch ram
29	Lift ram
30	2/4 wheel steer selector valve
40	Anti-cavitation valve

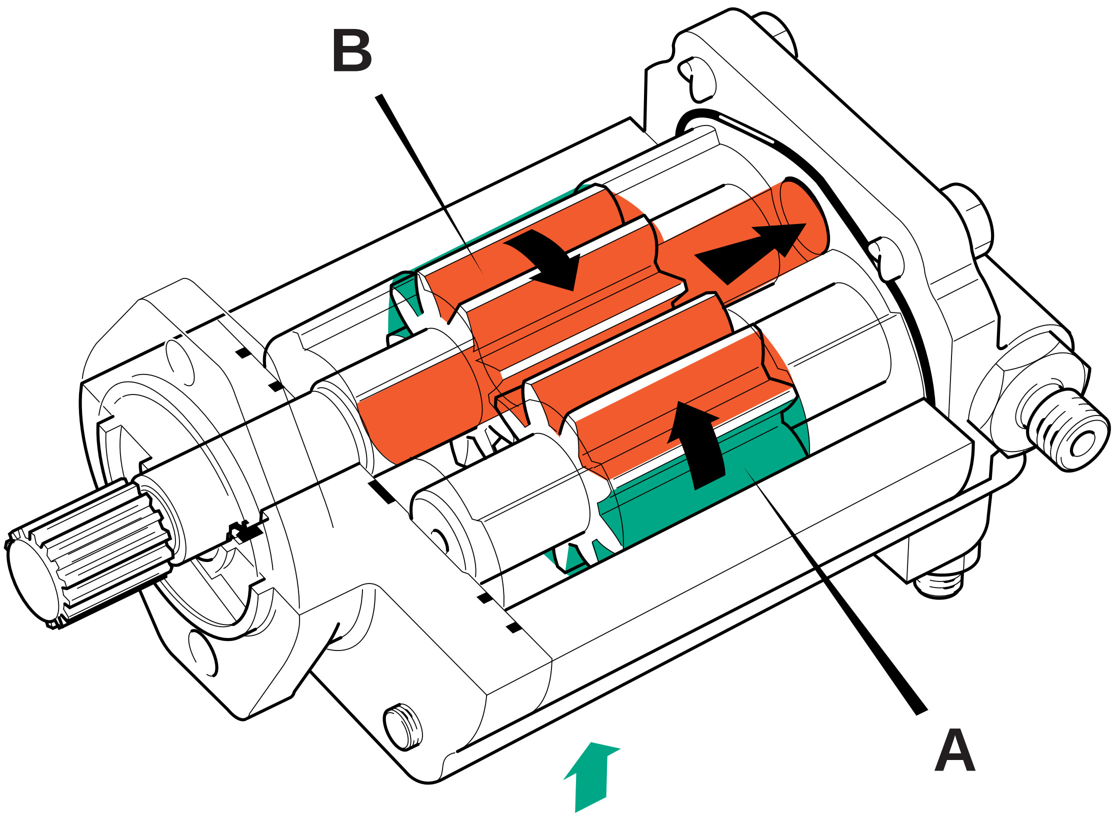
Hydraulic Pump Operation (Typical)

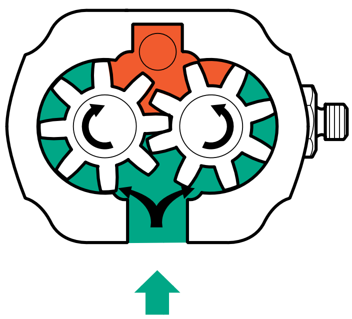
The hydraulic pump is a gear type. The basic principle of the pump depends on the meshing of the two spur gears **A** and **B**, one of which is engine-driven whilst the other is an idler. Oil is picked up on the inlet side of the pump by the gears and carried round between the gear teeth and the pump body. As the gears come into mesh the oil is forced through the pump outlet port.

Lubrication is provided by the hydraulic oil which is directed around the unit, via special oil ways, by the motion of the meshing gears.

Component Key:

A Spur Gear - Idler
B Spur Gear - Driven





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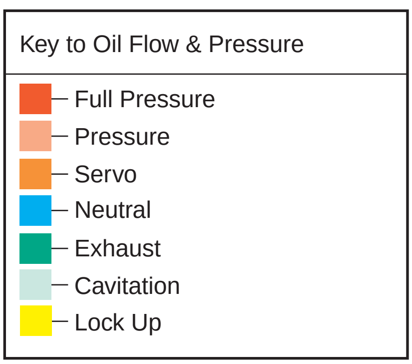

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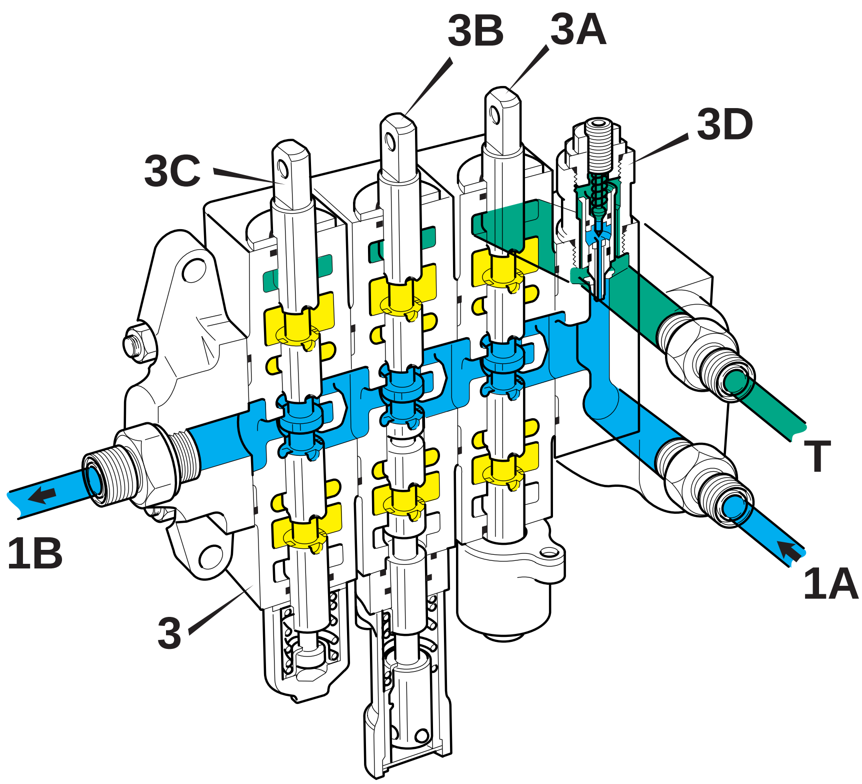

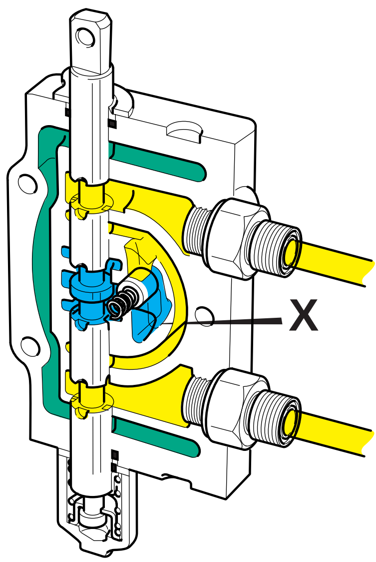

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Key to Oil Flow & Pressure

- Full Pressure
- Pressure
- Servo
- Neutral
- Exhaust
- Cavitation
- Lock Up

A390630

Loader Valve Neutral Circuit

The loader valve is mounted on the chassis frame, right hand side (when viewed from the rear).

It includes the shovel ram spool **3A**, lift ram spool **3B** and auxiliary spool **3C**. Linkage rods connect the spool ends to the control levers.

Oil from the pump enters the loader valve at **1A.** When all the spools are in neutral as shown, the oil passes around the waisted central portions of the spools and flows on to feed the excavator valve via high pressure carry over line **1B.**

Oil also fills the parallel gallery **X**.

The exhaust gallery is connected to the tank return line via port **T**.

Component Key:

T Tank Port
X Parallel gallery
1A Pump Inlet
1B High Pressure Carry Over Port
3 Loader Valve Block
3A Shovel Ram Spool
3B LIft Ram Spool
3C Auxiliary Spool
3D Main Relief Valve

Loader Valve - Load Hold Check Valves

Component Key:

X Parallel Gallery
Y Service Line
1A Pump Inlet
3B Lift Ram Spool
3H Load Hold Check Valve
24 Lift Ram
25 Lift Ram

Operation 1

The illustration shows 'arms raise' being selected by the lift ram spool **3B.**

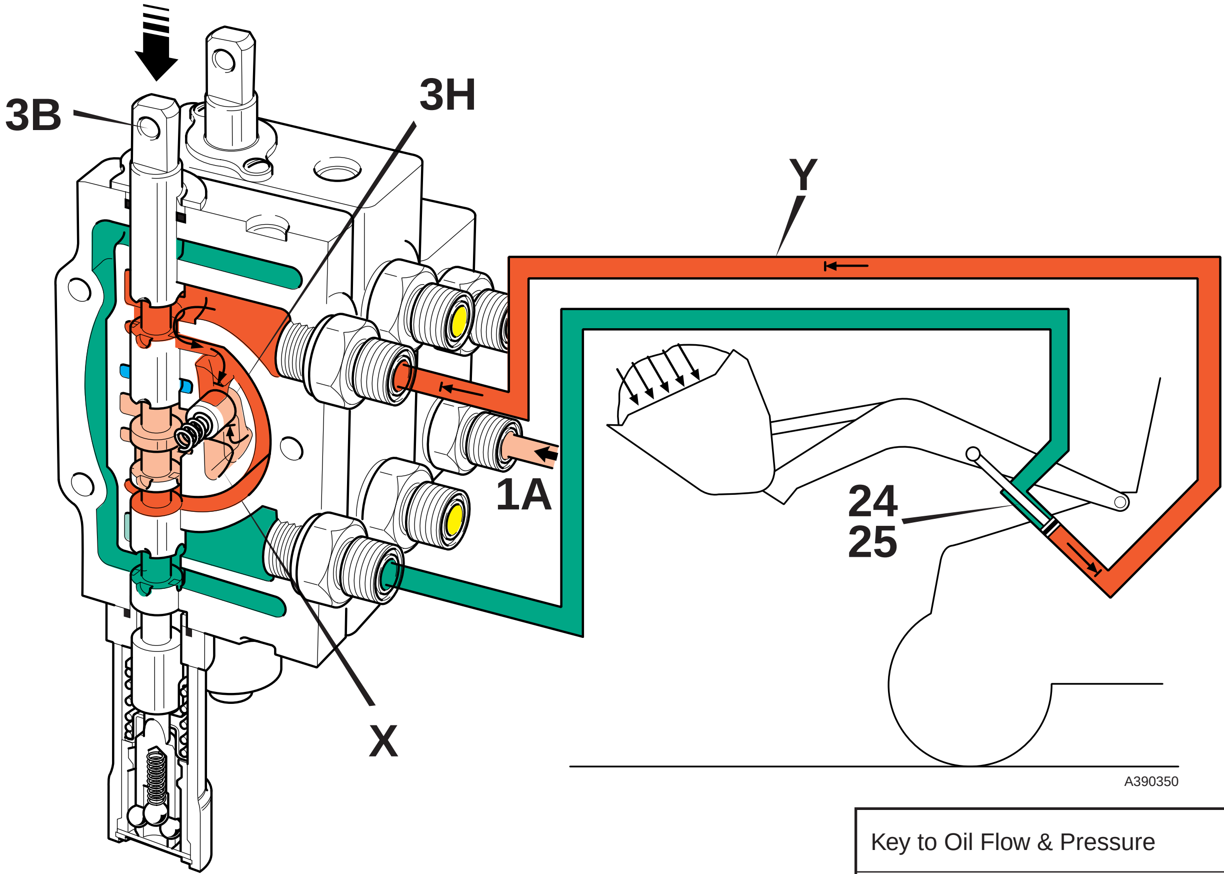
The weight of the loaded shovel, as indicated by the arrows, produces a higher pressure in service line **Y** than in the parallel gallery **X**.

This pressure differential causes load hold check valve **3H** to close, thus preventing the load from dropping.

Operation 2

As the neutral circuit has been blocked by the central lands of the selected spool **3B,** the pressure in parallel gallery **X** increases until it is greater than that in service line **Y**.

At this point, load hold check valve **3H** opens, allowing oil to flow from the parallel gallery into the service line and operate the lift rams **24** and **25**.



Key to Oil Flow & Pressure

- Full Pressure
- Pressure
- Servo
- Neutral
- Exhaust
- Cavitation
- Lock Up

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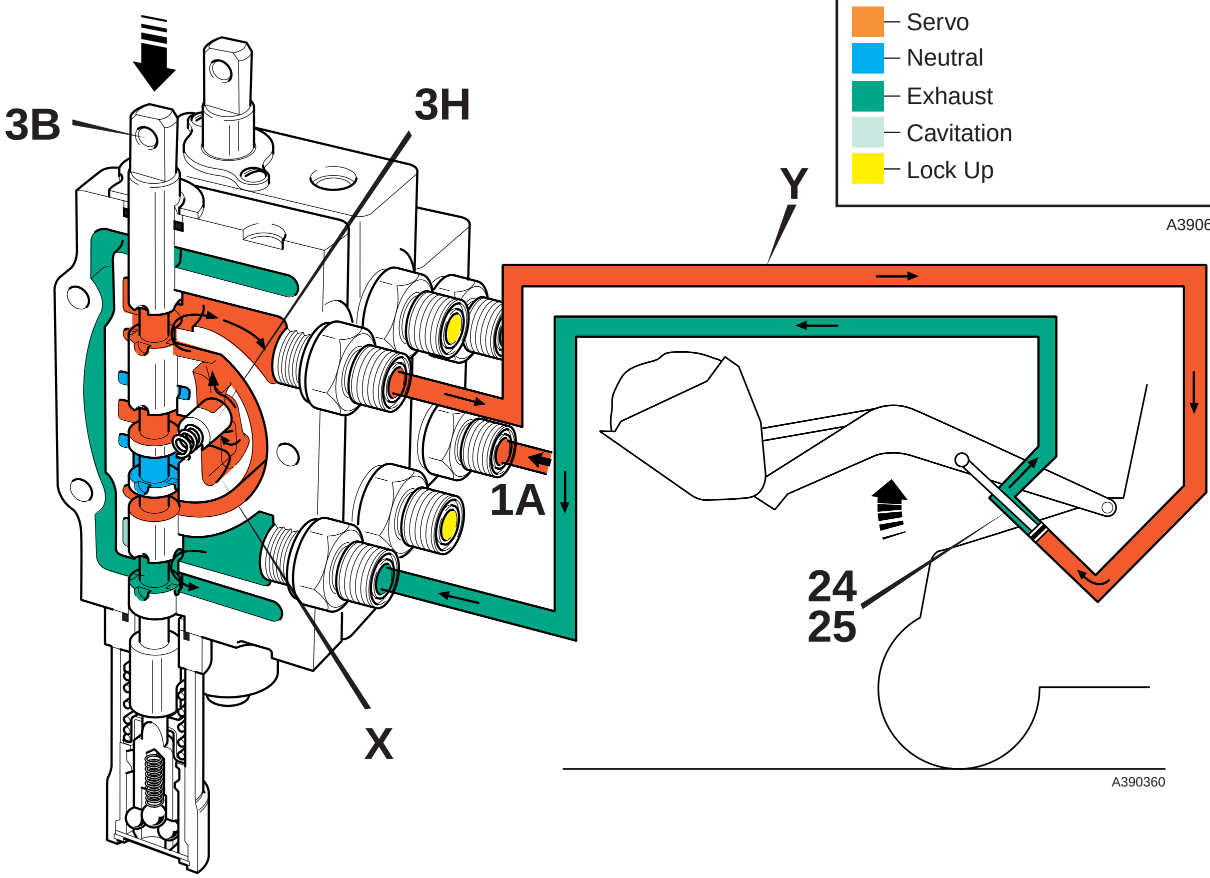

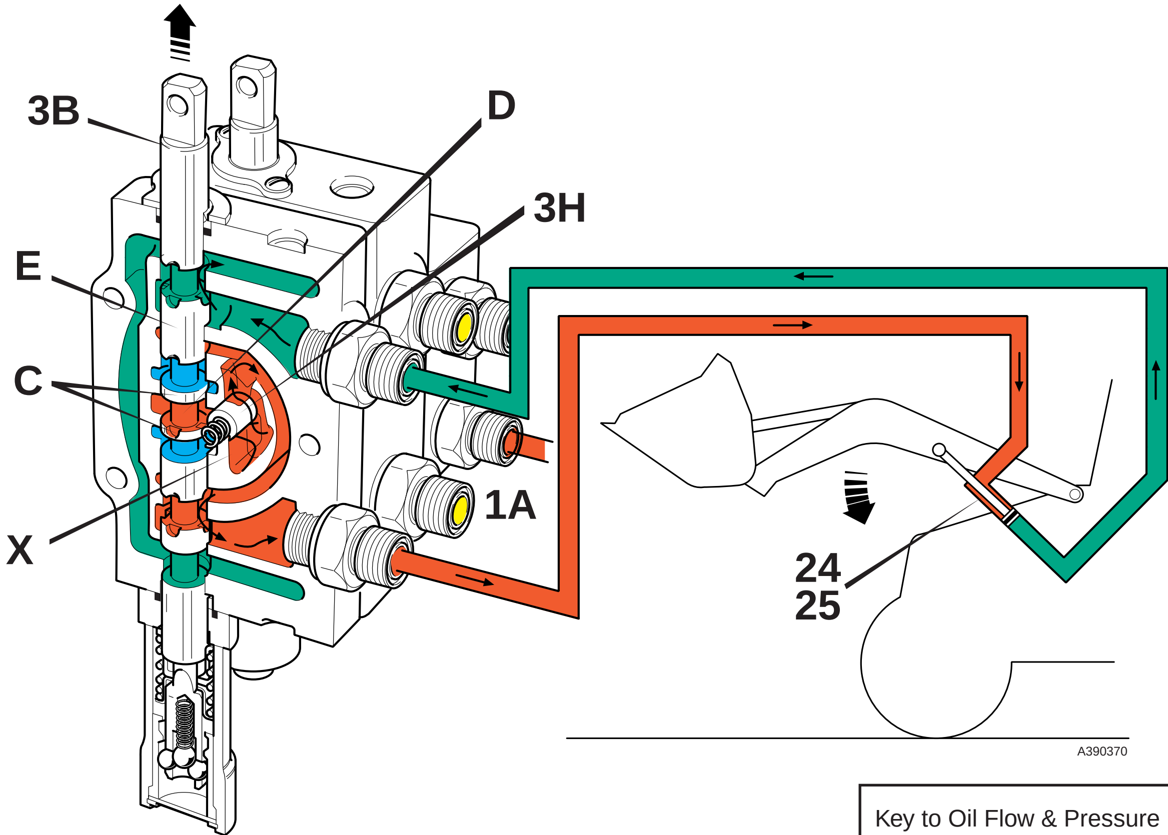

Key to Oil Flow & Pressure

- Full Pressure
- Pressure
- Servo
- Neutral
- Exhaust
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- Lock Up

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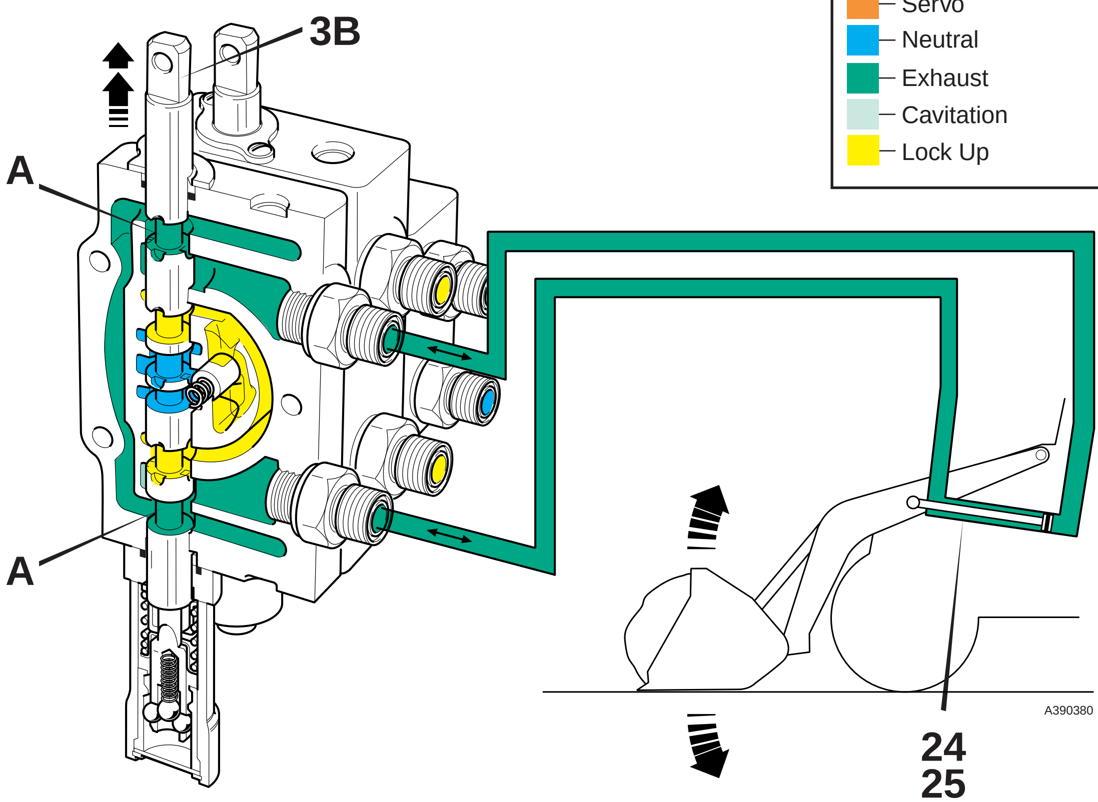


Loader Valve

Arms Lower

When a spool is selected as shown at **3B,** the central lands of the spool **C** block the neutral circuit. Oil from the pump, entering at **1A**, is diverted into the parallel gallery **X**, flows around the waisted section of the spool **D**, opens the load hold check valves **3H** and **3G** (not illustrated), and out to the rod side of lift rams **24** and **25**.

The upper land of the selected spool **E** blocks the flow from the parallel gallery to the head side port and oil returning from the rams is diverted into the exhaust gallery.

Component Key:

A Spool Waist
C Spool Lands
D Spool Waist
E Upper Waist
X Parallel Gallery
1A Pump Inlet
3B Lift Ram Spool
3H Load Hold Check Valve
24 Lift Ram
25 Lift Ram

Float

The float facility is provided to allow the arms to move up and down so that the shovel can follow the surface contours as the machine is driven over uneven ground.

This is achieved by moving the lift spool **3B** up beyond 'arms lower' into the 'float' detent, when the feed from the parallel gallery to the service ports is blocked and the neutral circuit is re-opened. Both service ports are connected to exhaust via the spool waists **A**.

Oil can then be displaced from either end of the lift rams **24** and **25** into the exhaust gallery, allowing the rams to open and close as required.

Loader Valve - A.R.V. Operation

Component Key:

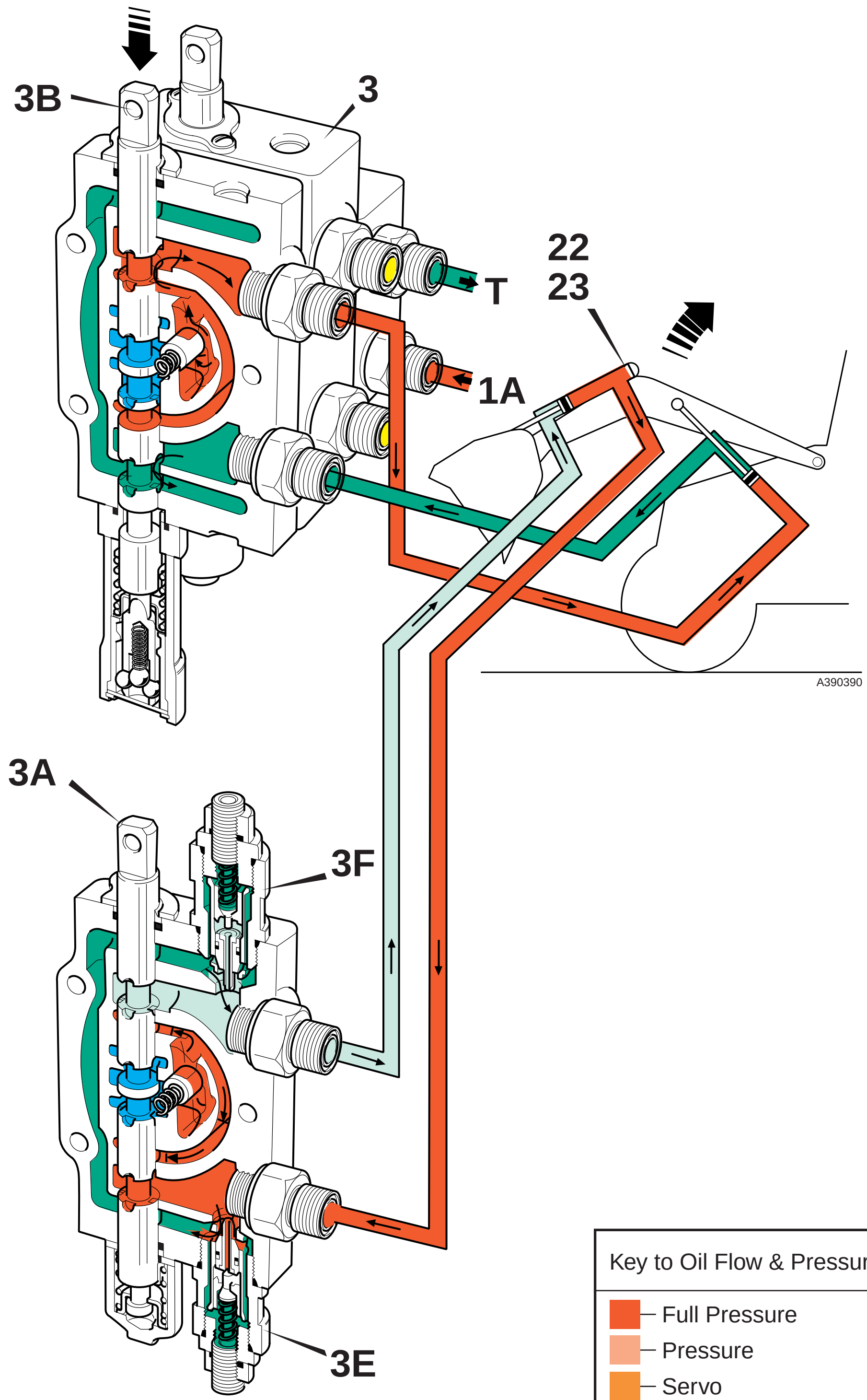
T Tank Port
1A Pump Inlet
3 Loader Valve Block
3A Shovel Ram Spool
3B Lift Ram Spool
3E ARV - Head Side
3F ARV - Rod Side
22 Shovel Ram
23 Shovel Ram

Under normal operating conditions, with the shovel in the 'carry' position, the mechanical linkage keeps the shovel level as the arms are raised, to prevent spillage of the load.

If, as illustrated, the shovel is fully tipped when the arms are being raised, the shovel is unable to tip further, producing back pressure in the head side of the shovel rams **22** and **23** and cavitation in the rod side.

As the arms continue to rise, the back pressure increases until it reaches the setting of A.R.V. **3E**. This A.R.V. then opens, allowing the excess back pressure to be dumped to exhaust and prevent the rams and linkage from being damaged.

The rod side A.R.V. **3F** senses a higher pressure in the exhaust gallery than in the service port and therefore opens to allow exhaust oil to overcome the cavitation.



Key to Oil Flow & Pressure

- Full Pressure
- Pressure
- Servo
- Neutral
- Exhaust
- Cavitation
- Lock Up

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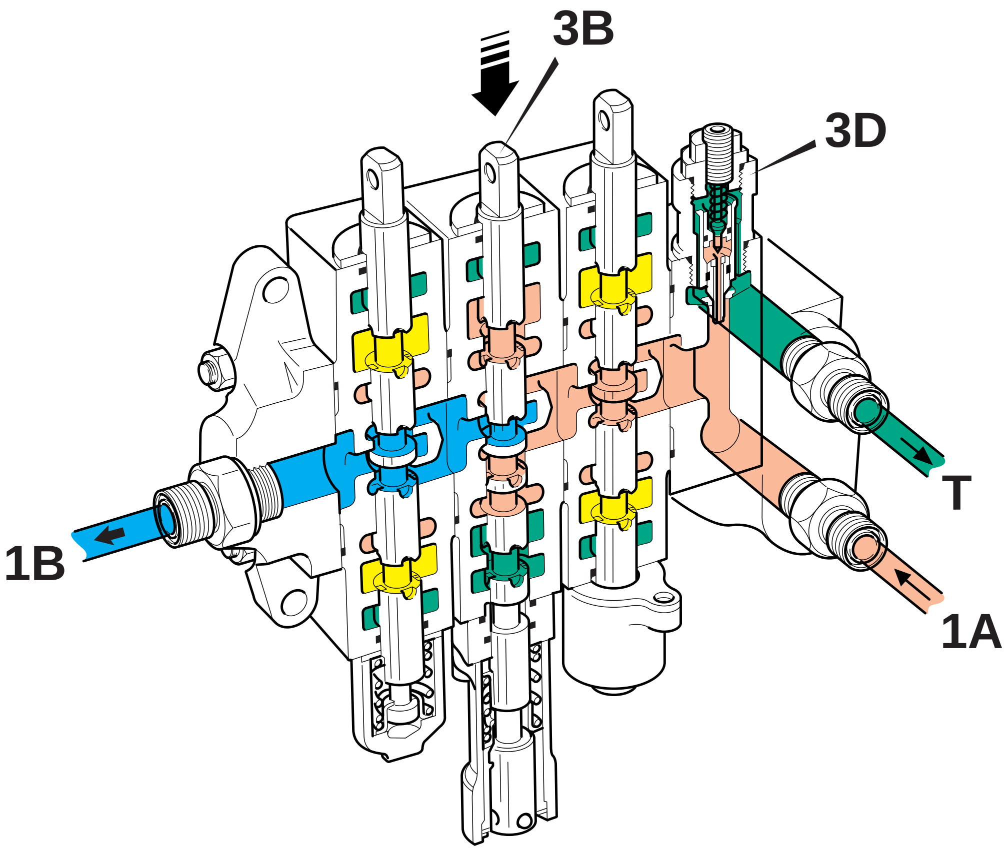

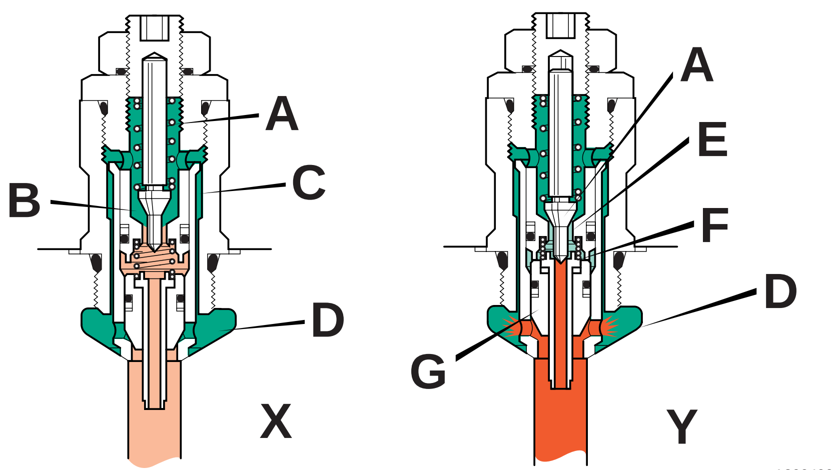

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Key to Oil Flow & Pressure

- Full Pressure
- Pressure
- Servo
- Neutral
- Exhaust
- Cavitation
- Lock Up

A390630

Main Relief Valve - Operation

The main relief valve (M.R.V.) **3D,** situated in the loader valve block, provides control of both loader and excavator pressures.

The illustration shows a loader service selected by spool **3B** causing pressure to rise in the service line. In the main view the service is operating under light load and the pressure is not sufficient to cause any response in the M.R.V.

View **X**.

As service pressure reaches the pilot setting of the valve, pilot poppet **A** lifts, allowing oil to escape into cavity **B** and pass down the sides of sleeve **C** into the exhaust gallery **D.**

View **Y**.

As service pressure continues to rise and oil escapes from cavity **E**, the pressure differential between the upper and lower surfaces of piston **F** causes this piston to rise and seat on the point of pilot poppet **A**.

Oil continues to escape from cavity **E** but the incoming flow to the cavity has been cut off. This produces a pressure drop above poppet **G**, causing the poppet to lift and release service pressure into exhaust gallery **D**.

For a further detailed description, refer also to **Pilot Operated Pressure Relief Valve Operation**.

Component Key:

A Pilot Poppet
B Cavity
C Sleeve
D Exhaust Gallery
E Cavity
F Piston
T Tank Port
G Poppet
1A Pump Inlet
1B High Pressure Carry Over Port
3D Main Relief Valve
3B Lift Ram Spool

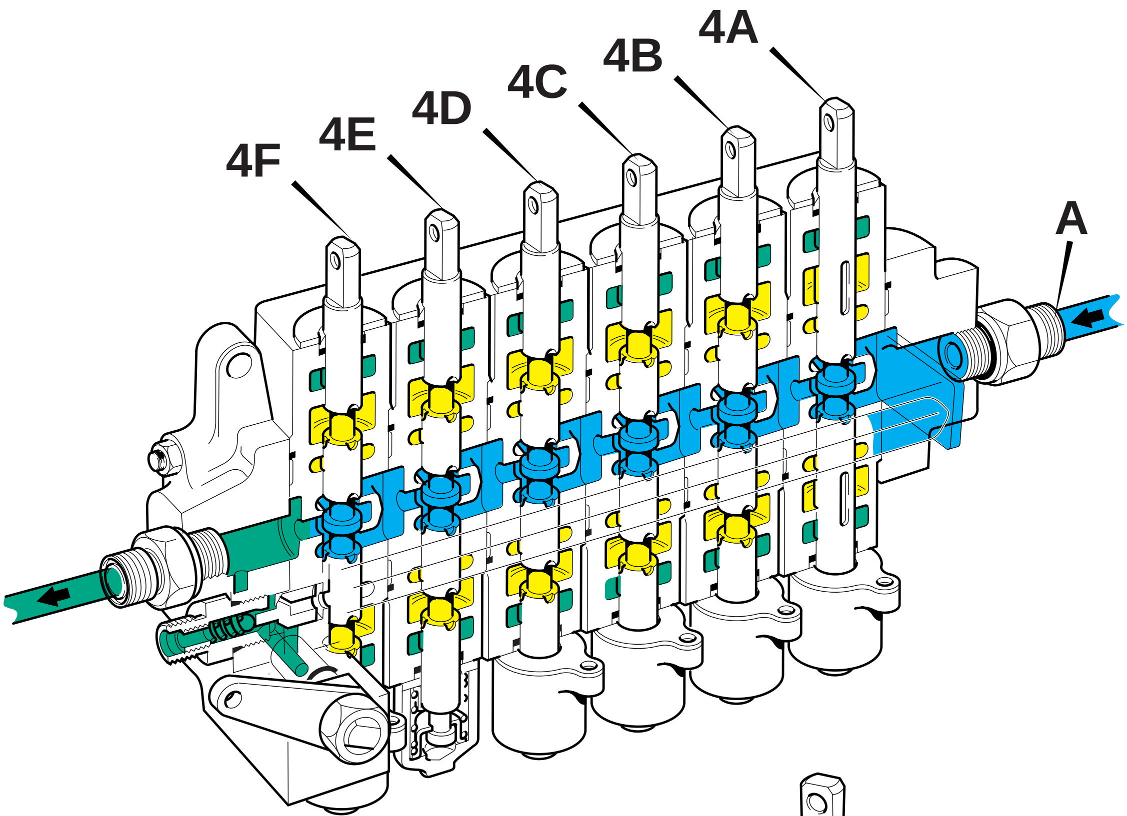
Excavator Valve Neutral Circuit

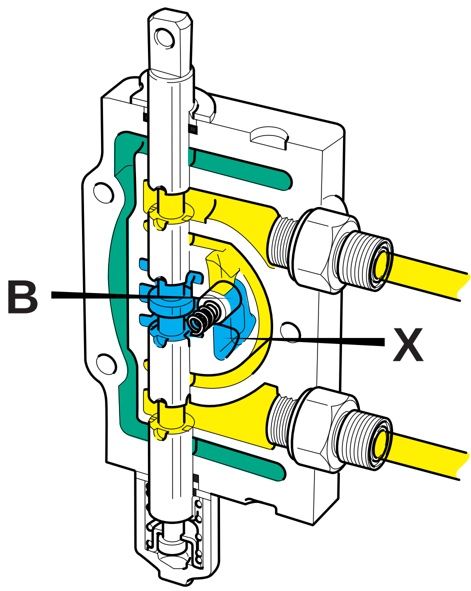
Component Key: (JCB 'X' Control Pattern)

A Inlet
B Load Hold Check Valves
X Parallel Gallery
4A Slew Spool
4B Boom Spool
4C Stabiliser Spool
4D Stabiliser Spool
4E Dipper Spool
4F Bucket Spool

Note: Machines with ISO control pattern have the boom and dipper spools interchanged.

Oil from the loader valve enters the excavator valve at **A** and flows through the neutral gallery and around the waists of the solid spools. It also fills the parallel gallery **X** but is not at a high enough pressure to open the load hold check valves **B**.





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Key to Oil Flow & Pressure

- Full Pressure
- Pressure
- Servo
- Neutral
- Exhaust
- Cavitation
- Lock Up

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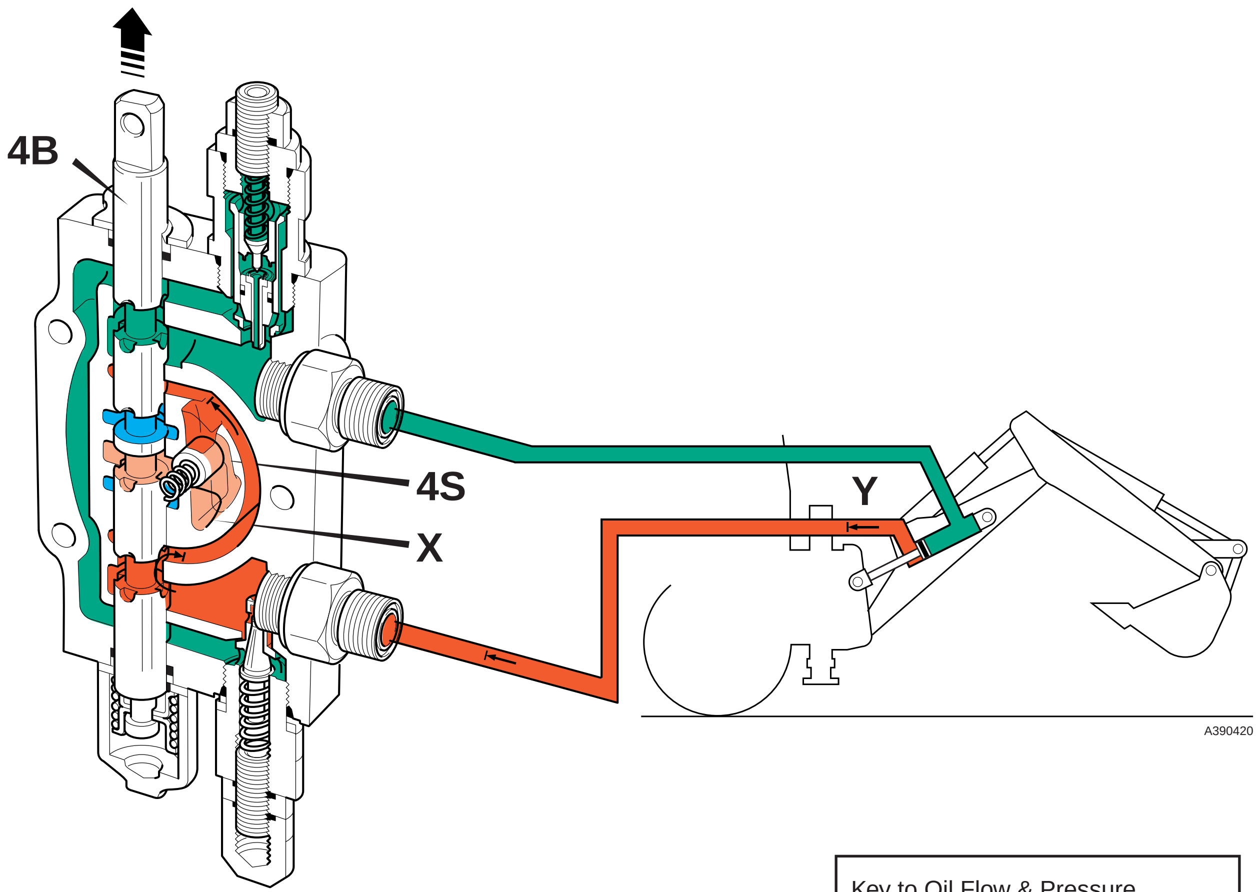

Key to Oil Flow & Pressure

- Full Pressure
- Pressure
- Servo
- Neutral
- Exhaust
- Cavitation
- Lock Up

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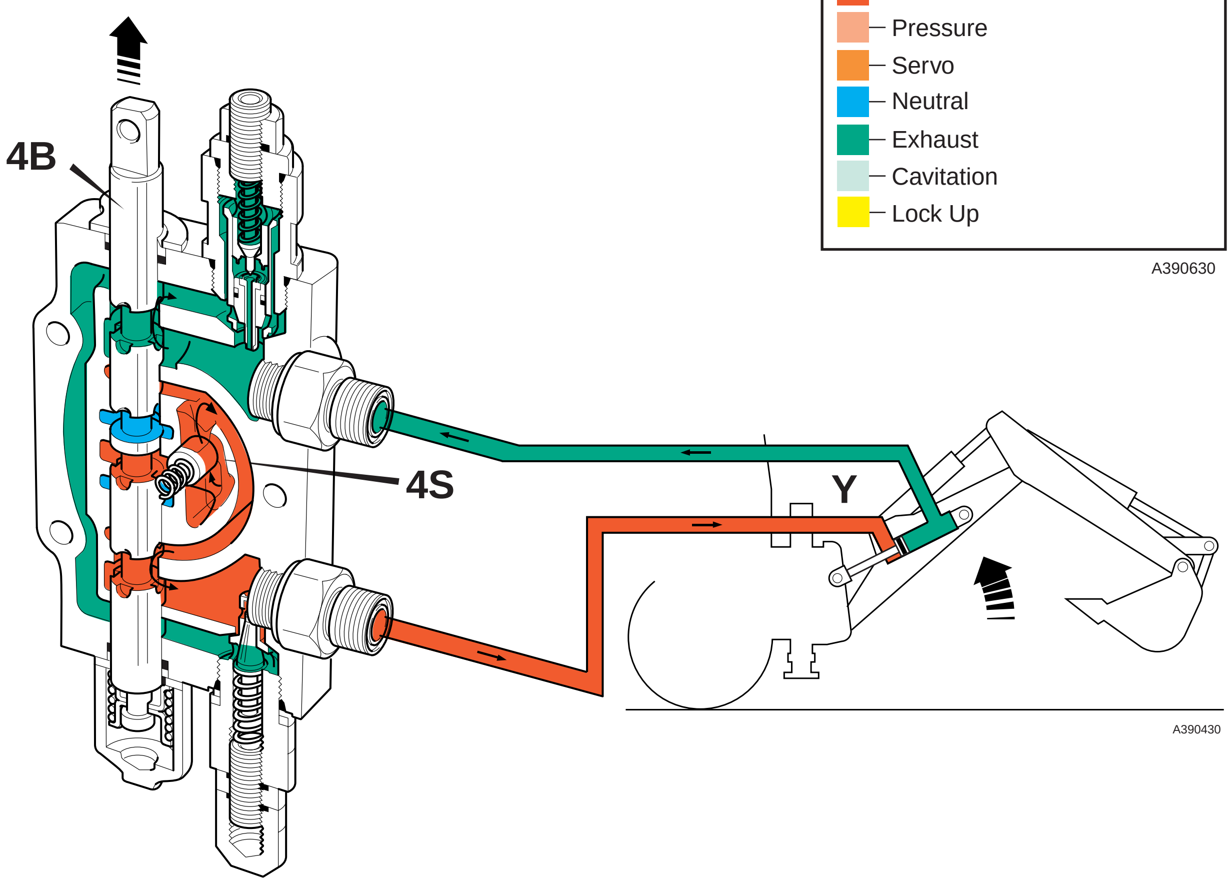


Excavator Valve - Load Hold Check Valves

Operation 1

Flow to the service via a typical solid spool **4B** is controlled by the load hold check valve **4S** which is a spring-loaded non-return valve operating across the pressure feed from the parallel gallery **X**.The valve prevents reverse flow from the rams into the pressure feed line, so maintaining ram pressure until exceeded by system pressure. The illustration shows a service selected but back pressure **Y** exceeds system pressure which closes the load hold check valve **4S**.

Component Key:

X Parallel Gallery
Y Service Line
4B Spool
4S Load Hold Check Valve

Operation 2

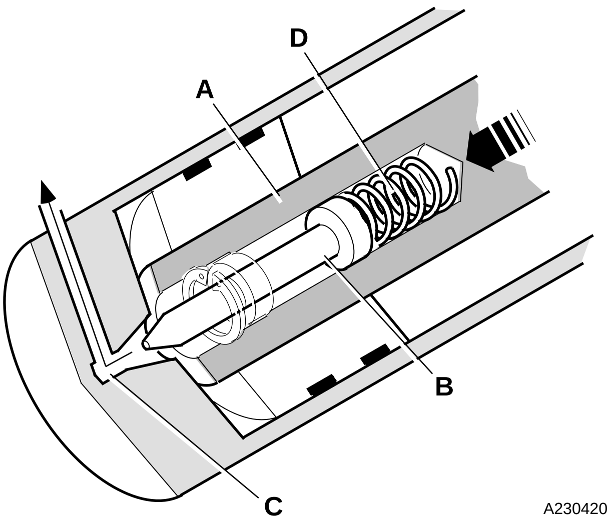
When pressure in the feed line exceeds back pressure, the load check valve **4S** opens and oil operates the ram. The remaining load hold check valves are also opened by system pressure but the galleries are dead-ended because the spools are in neutral.

Componet Key:

C Lower Service Port
D Upper Service Port
E Bi-Restrictor
X Parallel Gallery
4A Slew Spool
4B Boom Spool
4H ARV
4J ARV

Slew Ram End Damping

As ram **A** nears the closed position, damping rod **B** seats in cone **C**, where it is held by spring **D**. Tapered flutes on the end of the rod produce a restricting orifice, thus restricting the speed of the oil being exhausted from the ram. This provides a cushioning effect between the piston and the dump end of the ram, effectively damping out the shock loads which would otherwise occur when the boom reaches the end of its slewing arc.



A Ram
B Damping Rod
C Cone Seat
D Spring

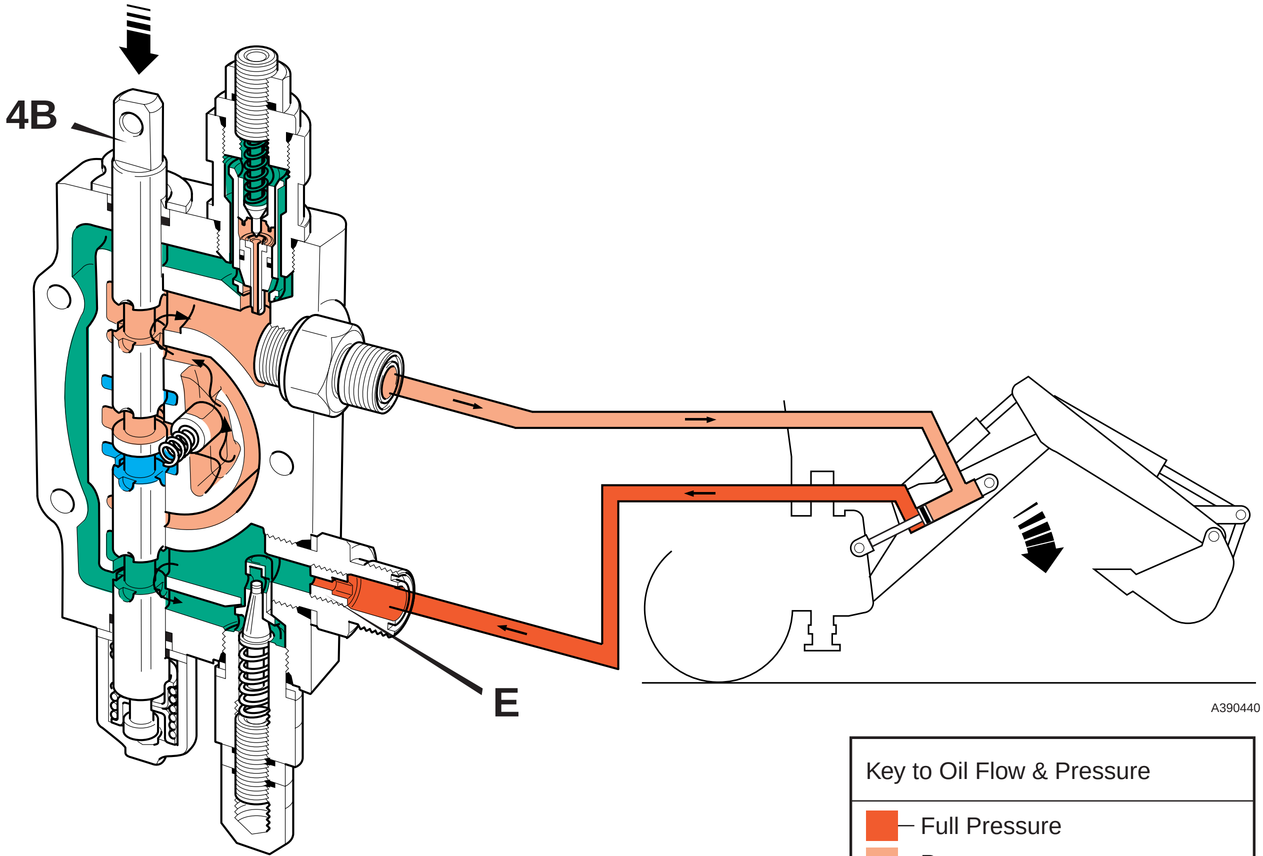
Excavator Valve - Bi-Restrictor Operation

Because of its weight, the excavator end could take over control when boom lower was selected. The falling boom would tend to push oil out of the ram faster than the head side was being filled. Consequently, when the excavator had reached the ground, there would be a time lapse while the ram filled with oil before the service would operate again.

To prevent this from happening, the boom service is fitted with bi-restrictor **E**.

Excavator Valve - Slew Operation

The illustration shows R.H. slew selected. The lower port **C** has been pressurised by the spool. Oil flows from the parallel gallery **X**, out past A.R.V. **4J** to both the head side of the L.H. slew ram and the rod side of the R.H. slew ram. The boom therefore slews to the right hand side of the machine. Displaced oil from the rod side of the L.H. slew ram and from the head side of the R.H. slew ram flows back through the upper service port **D** and back to tank.



Key to Oil Flow & Pressure

- Full Pressure
- Pressure
- Servo
- Neutral
- Exhaust
- Cavitation
- Lock Up

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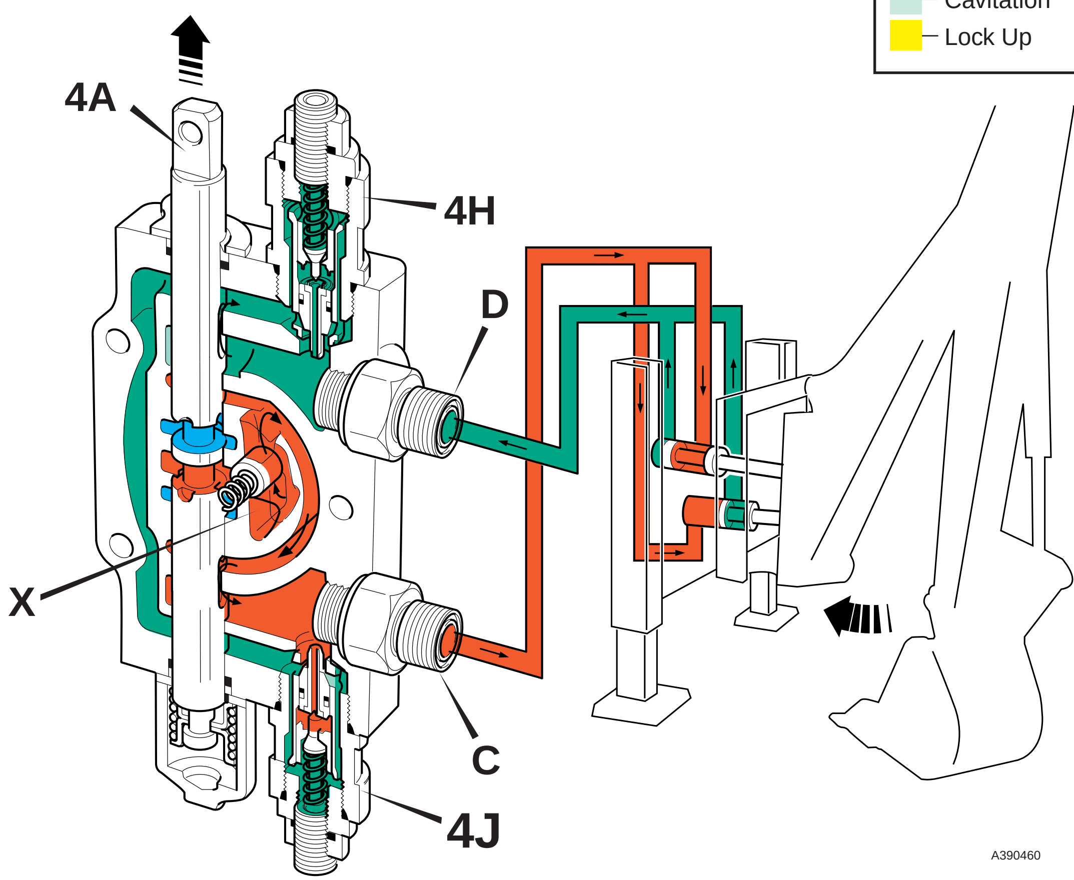

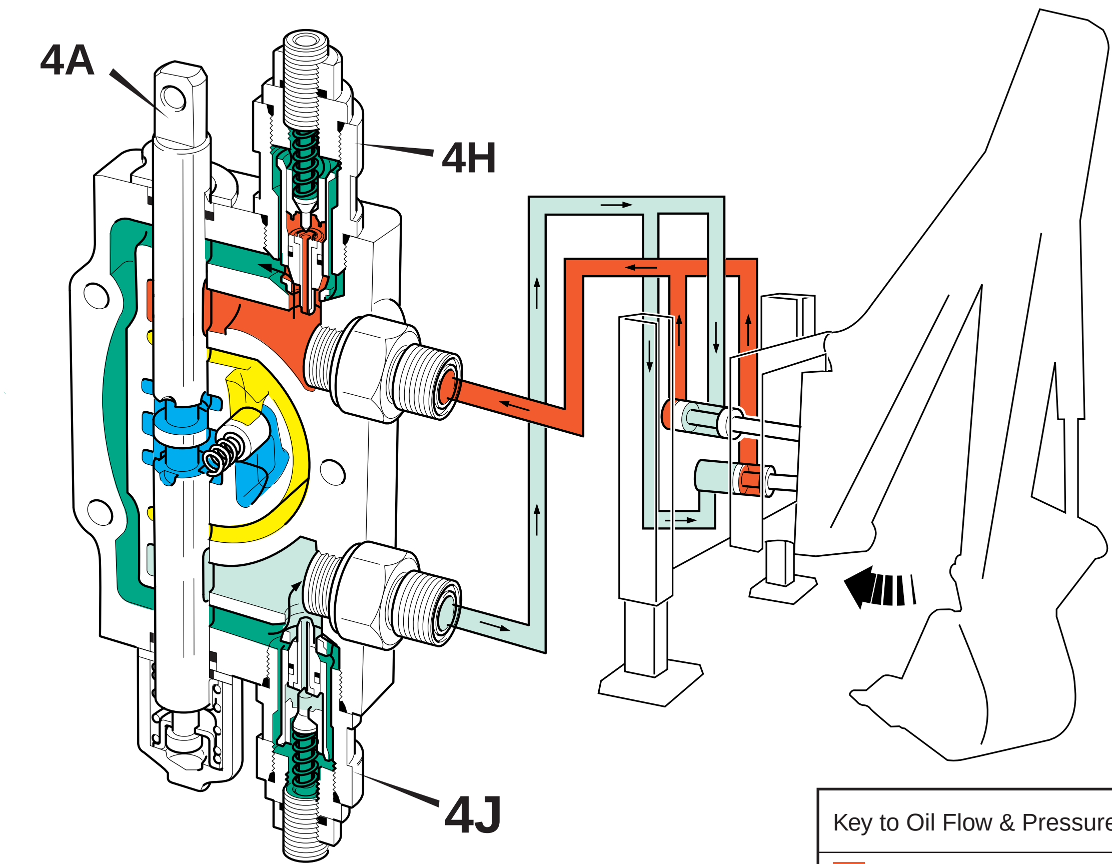

Key to Oil Flow & Pressure

- Full Pressure
- Pressure
- Servo
- Neutral
- Exhaust
- Cavitation
- Lock Up

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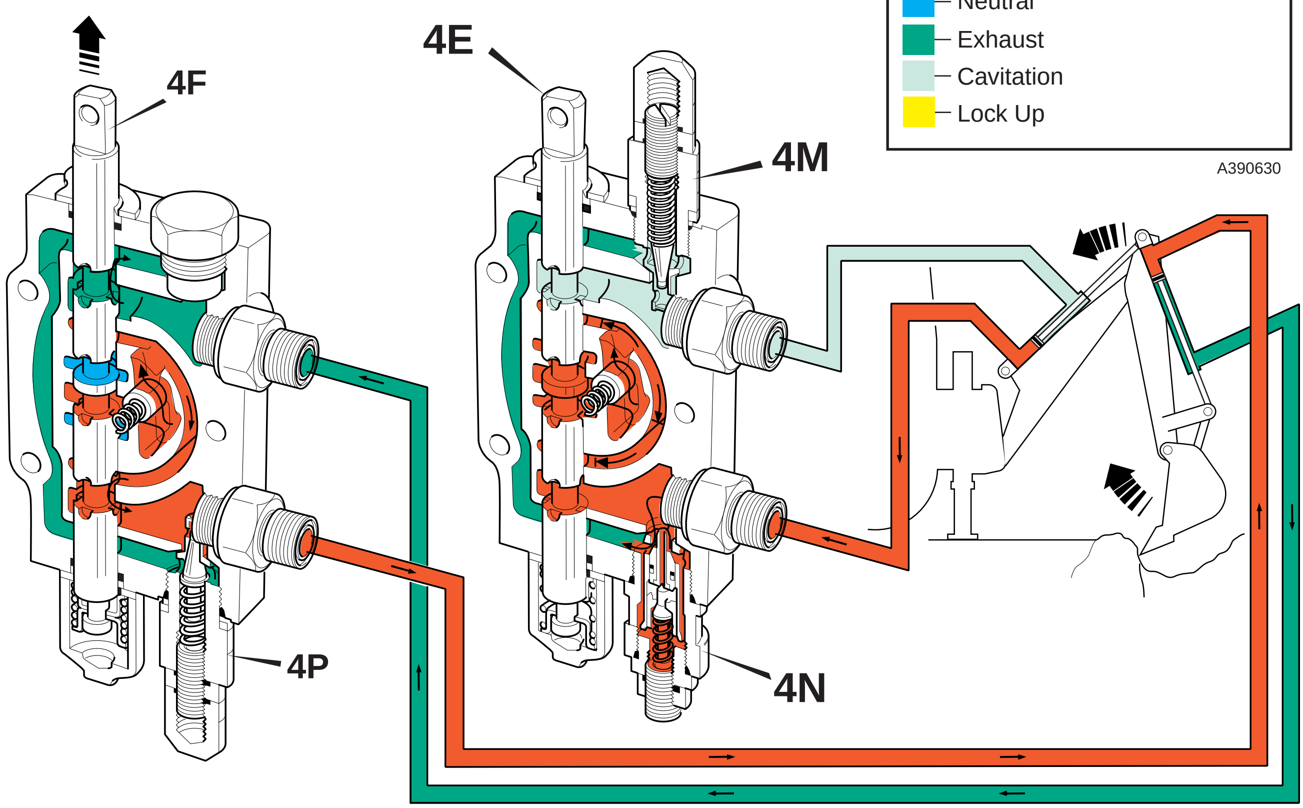

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Excavator Valve - Slew A.R.V. and Anti-Cavitation Operation

The spool **4A** is in neutral but the momentum of the slewing excavator end creates back pressure in the head side of the R.H. slew cylinder and in the rod side of the L.H. slew cylinder. This opens A.R.V. **4H** and dumps oil to exhaust. At this point the cylinders cavitate and exhaust oil pressure causes A.R.V. **4J** to open, allowing oil from the exhaust gallery to fill the L.H. cylinder.

Componet Key:

4A Slew Spool
4E Dipper Spool
4F Bucket Spool
4H ARV
4J ARV
4M ARV
4N ARV
4P ARV

Excavator Valve - A.R.V. Operation

The illustration shows the bucket spool **4F** selected to operate the service against an immovable object. This forces the dipper away from the obstruction and pressurises the head side of the dipper ram.

When this pressure reaches the setting of A.R.V. **4N**, this valve opens, relieving the pressure into the exhaust gallery. Cavitation occurs in the rod side of the dipper service.

For a further detailed description, refer also to **Pilot Operated Pressure Relief Valve Operation**.

Pilot-Operated Pressure Relief Valve Operation

Component Key:

A Service Pressure
B Poppet
C Piston
D Spring
E Poppet
F Spring
G Locknut
H Cavity
J Sleeve
K Exhaust Cavity
L Cavity

1 Valve at Rest

A.R.V's are positioned in the excavator valve block in order to relieve excessive pressure in the services as shown on page E-7- 7.

When the service is in neutral and there are no excessive forces acting on the equipment, service pressure at **A** will be acting on the lower face of poppet **B** and will also be felt inside the valve via hollow piston **C**.

The force of springs **D** and **F**, combined with the service pressure acting on the upper faces of poppet **B** and piston **C**, keeps poppets **B** and **E** tightly seated.

The force of spring **F** is adjustable to suit the relevant service by means of adjuster screw and locknut **G**.

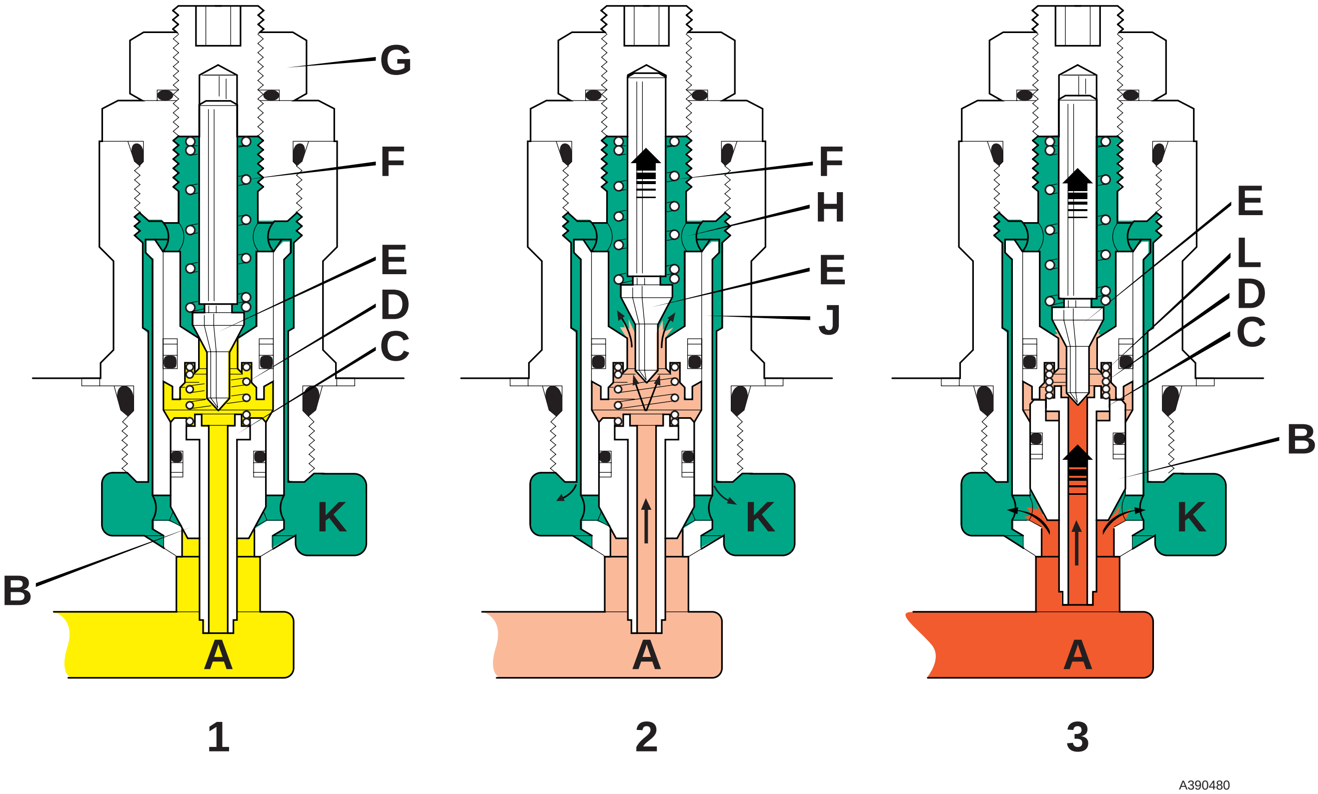
2 Pilot Valve Opens

As service pressure reaches the pilot setting of the valve, pilot poppet **E** lifts, allowing oil to escape into cavity **H** and pass down the sides of sleeve **J** into the exhaust gallery **K**.

3 Main Poppet Opens

As service pressure continues to rise and oil escapes from cavity **L**, the pressure differential between the upper and lower surfaces of piston **C** causes this piston to rise and seat on the point of pilot poppet **E**.

Oil continues to escape from cavity **L** but the incoming flow to the cavity has been cut off. This produces a pressure drop above poppet **B**, causing the poppet to lift and release service pressure into exhaust gallery **K**.



Key to Oil Flow & Pressure

- Full Pressure
- Pressure
- Servo
- Neutral
- Exhaust
- Cavitation
- Lock Up

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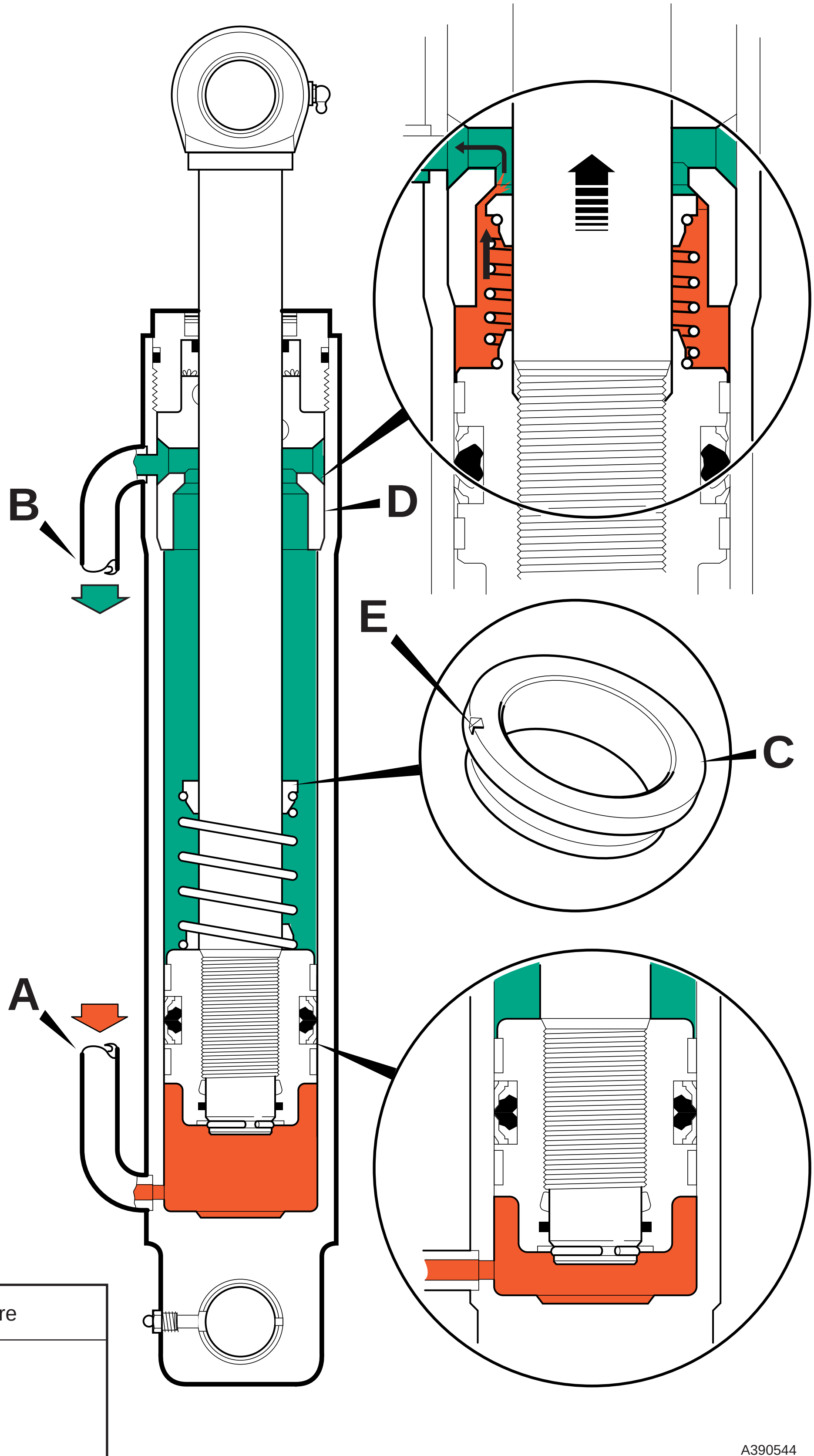


Key to Oil Flow & Pressure

- Full Pressure
- Pressure
- Servo
- Neutral
- Exhaust
- Cavitation
- Lock Up

A390630

Ram Operation and End Damping

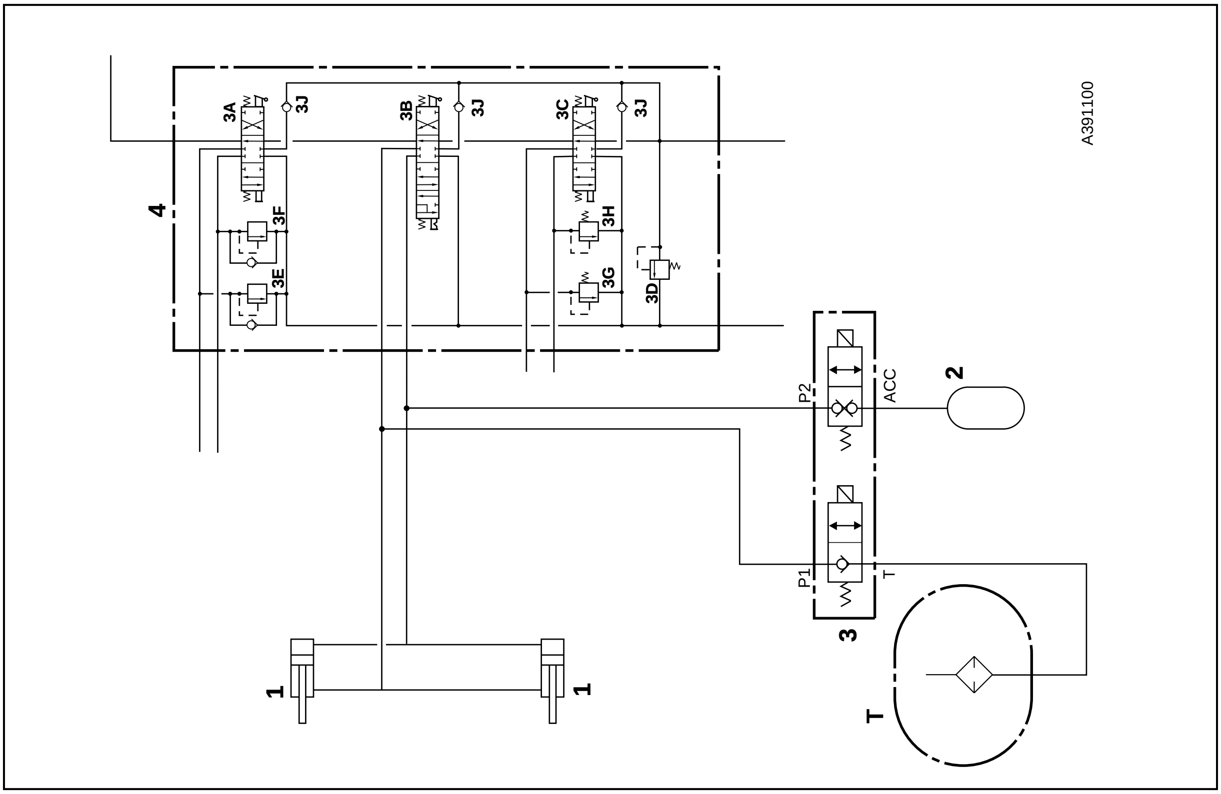
The illustration shows pressurised oil fed to the head side of the ram via port **A**. As the pressurised oil causes the ram to move up the cylinder bore, exhaust oil is vented from the rod side of the rem via port **B**.

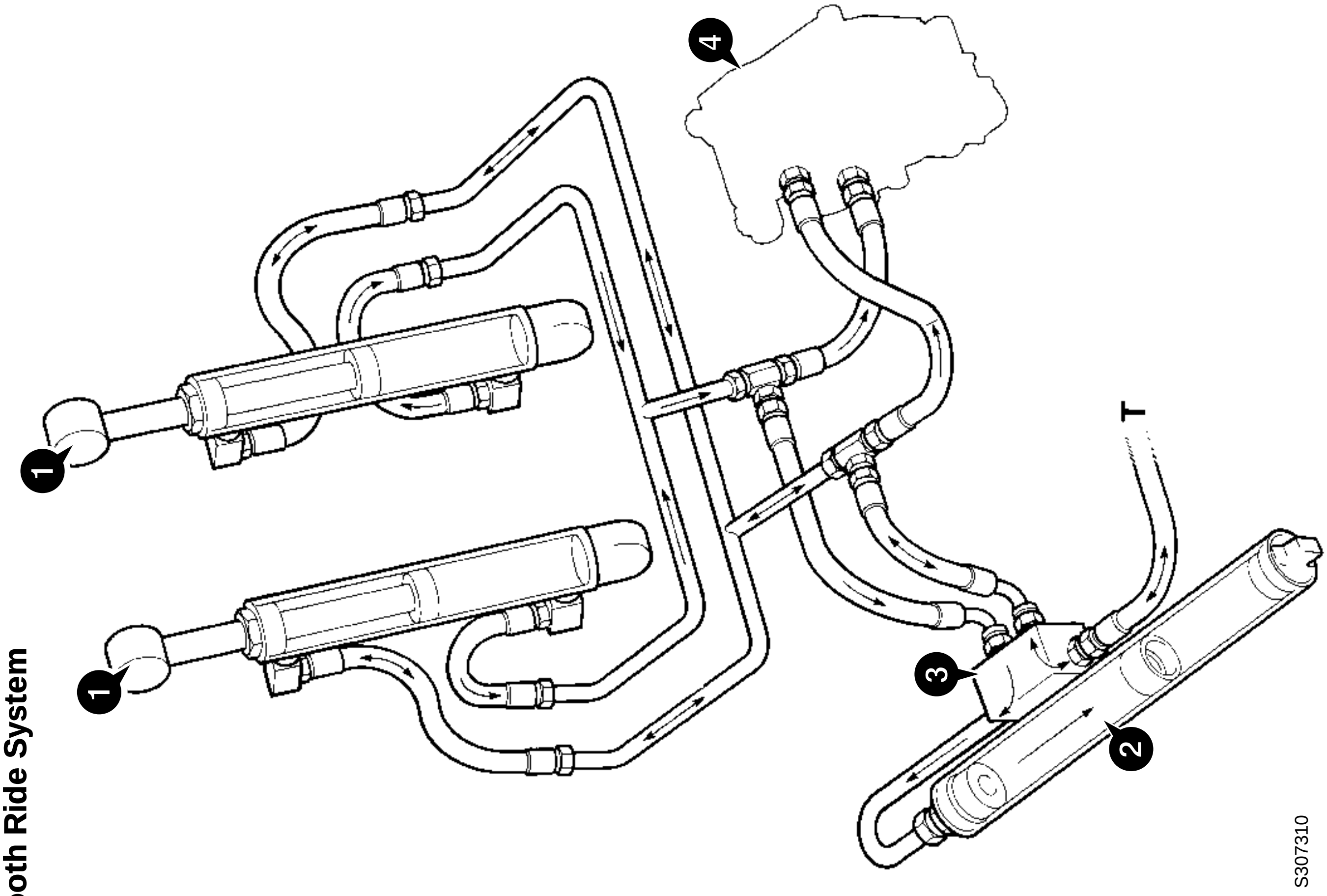
Spring mounted collar **C** is used to 'dampen' the end travel of the ram. As the ram approaches full travel, the outer diameter of the collar contacts the chamfer of gland bearing **D**, preventing the exhaust oil from venting. Oil flow to exhaust is restricted through small slot **E**. Restriction of oil flow slows or 'dampens' ram final travel.

Component Key:

A Head Side Port
B Rod Side Port
C Collar
D Gland Bearing
E Slot

Smooth Ride System





Smooth Ride System

Smooth Ride System (SRS) will enhance the comfort of the ride by damping out the forces imposed on the machine by the movement of the loader arms as the machine travels over uneven surfaces.

This is achieved by connecting the head side of the loader arms **1** to a pressurised piston type accumulator **2**.

When a switch in the cab is operated, selector valve **3** is energised and opens. Hydraulic oil from the piston head side is dead ended at the loader valve block **4** but is connected to the accumulator. The rod side of the loader ram is connected to tank **T** via the selector valve to make up or dissipate oil as required.

The smooth ride system will not function on machines fitted with hose burst check valves.

Fault Finding Contents

Introduction

The purpose of this section is to help you trace hydraulic faults to a faulty unit (valve, actuator, ram etc). Once you have traced the faulty unit, refer to the appropriate dismantling, inspecting and test instructions given elsewhere in the hydraulics section.

To help identify circuits, valves, rams etc mentioned in the fault finding procedures, refer to the hydraulic schematic diagrams (near the beginning of the Hydraulics Section).

1 Before you begin fault finding, read the Safety information at the beginning of this manual.

2 Make simple checks before say, stripping a major component.

3 Make sure that the hydraulic fluid is at correct working temperature (50 °C, 122 °F).

4 What ever the fault, check the condition of the hydraulic fluid. Drain and replace if necessary.

5 Make any relevant electrical checks before moving on to the hydraulics.

6 Be sure to remove ALL contamination and if possible identify its origin. It may be part of a component from elsewhere in the circuit.

7 Replace any seals such as 'O' rings before re-assembling hydraulic components.

Fault	Probable Cause	Action
1 Lack of power in all hydraulic functions.	Insufficient hydraulic fluid.	Check for leaks and top up as required.
	Hydraulic leaks in system.	Check hoses, replace as required.
	Engine performance.	Check engine performance, see transmission section for stall speed test procedures.
	Main relief valve (MRV) setting incorrect.	Check and adjust as required.
	Low pump flow.	Check pump flow, if required service or replace pump.
	Hydraulic tank breather	Clean or replace the breather
	Tank filter by-pass valve	Check condition of hydraulic filter

Fault	Probable Cause	Action
2 All hydraulic rams slow to operate.	Neutral circuit or low pressure lines leaking, damaged, trapped or kinked.	Check pipe lines and replace as required.
	Low pump flow.	Check pump flow, if required service or replace pump.
	Priority valve operating.	Check if the priority valve is sticking, rectify as required.
	Main relief valve (MRV) setting incorrect.	Check and adjust as required.
	Tank filter by-pass valve	Check condition of hydraulic filter
	Hydraulic tank breather	Clean or replace the breather
3 One hydraulic service fails to operate or is slow to operate.	Associated service pipe lines , leaking damaged, trapped or kinked.	Check hoses, replace as required.
	Associated ram leaking.	Complete ram leakage check, replace seals as required.
	Auxiliary relief valve (ARV) setting incorrect.	Check and adjust as required.
	Associated valve block section leaking or not operating.	Check for leaks, rectify as required. Also, see fault **6** 'Leaking Oil Seal (Control Valves)'.
		Make sure that the associated load hold check valve is operating.
		Check that the control lever and associated linkages is operating the spool, rectify as required. Also, see fault **5**, 'A spool is Sticking'.
	Check valve malfunctioning (if fitted, e.g. stabiliser circuit)	Test check valve, rectify as required.
	Hose burst protection valve (if fitted) malfunctioning.	Test HBPV, service as required.
	Piston rod is bent	Replace piston rod, check pressure settings of MRV and ARV.
		Check that associated pivot pins are adequately greased
4 The engine tends to stall when hydraulics are under load.	M.R.V setting incorrect.	Check and adjust as required.
	Poor engine performance.	Check engine performance, see transmission section for stall speed test procedures.

Fault	Probable Cause	Action
5 A spool is sticking.	Oil temperature abnormally high.	Check for correct fluid, see Lubricants and Capacities. Check oil cooler and grille for blockage.
	The hydraulic fluid is dirty.	Clean the tank strainer. If strainer badly clogged, drain and flush hydraulic system Fill with clean hydraulic fluid.
	The service pipe connection is over tightened.	Check tightening torque.
	The valve housing was twisted during installation.	Loosen retaining bolts and tighten to correct torque figures.
	Pressure too high.	Check system pressure.
	A control linkage is bent	Disconnect the linkage. Repair the linkage if possible, or fit a new one.
	A spool is bent	Dismantle the control valve. Renew spool as necessary.
	A return spring is broken.	Renew as necessary.
	A return spring or cap is out of alignment.	Remove the cap, check that the spring is in the correct position. Refit cap and torque tighten bolts
	Temperature distribution within control valve not uniform.	Warm the entire system up before using service.
6 Leaking Oil Seal (Control Valves)	Paint or dirt on the seal face.	Remove the seal and clean.
	The back pressure in the valve circuit is excessively high.	Check circuit pressures, adjust if possible. Otherwise investigate thoroughly.
	Spool damaged.	Dismantle. Inspect all parts. Renovate or renew as necessary.
	The seal is not secured.	Clean the seal and tighten the retaining bolts to the correct torque.
	The seal is cut or damaged.	Fit a new seal.
7 Ram creep.	Associated ram or pipe lines from ram leaking.	Check and rectify as required.
	Check valve malfunctioning (if fitted, e.g. stabiliser circuit)	Test check valve, rectify as required.
	Associated valve section spools leaking.	Rectify, check for contamination.
	Associated ARV leaking	Rectify, check for contamination .

Fault	Probable Cause	Action
8 Hydraulic oil becomes too hot	Oil cooler obstructed	Remove debris from cooler matrix fins.
	Restriction in neutral circuit lines	Check hoses, replace as necessary
	Hydraulic filter clogged and by-pass valve not working	Change hydraulic filter.

Smooth Ride System

	Fault	Probable Cause	Action
1	Unable to power down loader arms with system switched OFF.	Rod side solenoid valve open.	Check if solenoid operating, replace solenoid or selector valve as required.
2	Restricted loader arm suspension movement when switched ON.	Rod side solenoid valve closed.	Check if solenoid operating, replace solenoid or selector valve as required.
3	Springy loader arm lift with system switched OFF.	Head side solenoid valve open.	Check if solenoid operating, replace solenoid or selector valve as required.
4	No suspension, unable to power down when switched ON.	Head side solenoid valve closed.	Check if solenoid operating, replace solenoid or selector valve as required.
5	Accumulator gas pressure decrease.	Leak across accumulator piston.	Recharge, if frequent replace seals in accumulator.
6	Oil in gas side of accumulator.	Leak across accumulator piston.	Discharge, drain and recharge, if frequent replace seals in accumulator.
7	Increase in charge pressure.	Oil to gas leak across accumulator piston.	Discharge, drain and recharge, if frequent replace seals in accumulator.

Note: It is normal for the loader arms to lift or lower slightly, when SRS is switched ON.

Check fuse A1 replace as required.

Hydraulic Contamination

Hydraulic Fluid Quality

Construction machinery uses a large volume of fluid in the hydraulic system for power transmission, equipment lubrication, rust prevention and sealing.

According to a survey conducted by a pump manufacturer, seventy per cent of the causes of problems in hydraulic equipment were attributable to inadequate maintenance of the quality of the hydraulic fluid.

Therefore, it is obvious that control of the quality of the hydraulic fluid helps prevent hydraulic equipment problems and greatly improves safety and reliability. Furthermore from an economic angle it extends the life of the hydraulic fluid if quality is maintained.

Effects of Contamination

Once inside the system, hydraulic circuit contaminants greatly effect the performance and life of hydraulic equipment. For example, contaminants in a hydraulic pump develop internal wear to cause internal leakage and hence lower discharges. Wear particles generated will circulate with the hydraulic fluid to cause further deterioration in the performance of this and other equipment.

Contaminants also enter principal sliding sections of the equipment causing temporary malfunction, scuffing, sticking and leakage and can lead to major problems.

The main contaminants can be classified as follows:-

1 **Solid Particles** - sand, fibres, metallic particles, welding scale, sealing materials and wear particles etc.

2 **Liquid** - usually water and incompatible oils and greases.

3 **Gases** - Air, sulphur dioxide etc. which can create corrosive compounds if dissolved in the fluid.

These contaminants can appear during manufacture, assembly and operation.

Cleaning Operation

The purpose of cleaning oil is to remove contaminants of all types and sludge by filtering hydraulic fluid through a cleaning unit, as illustrated or similar. General Bulletin 011 also refers.

Procedure

Connect the cleaning unit in place of the hydraulic filter and run the system for sufficient time to pump all the hydraulic fluid through the unit. Disconnect the cleaning unit and reconnect the filter. Top up the system with clean hydraulic fluid as required.

Contaminant Standards

Dirt that damages your system is in many cases too small to be seen with the eye. The particle size is measured in microns.

1 micron= 0.001 mm (0.0000394 in)

Listed below are a few typical comparisons:-

Red Blood Cell	= 8 microns (0.008 mm, 0.000315 in)
Human Hair	= 70 microns (0.07 mm, 0.00275 in)
Grain of Salt	= 100 microns (0.1 mm, 0.00394 in)

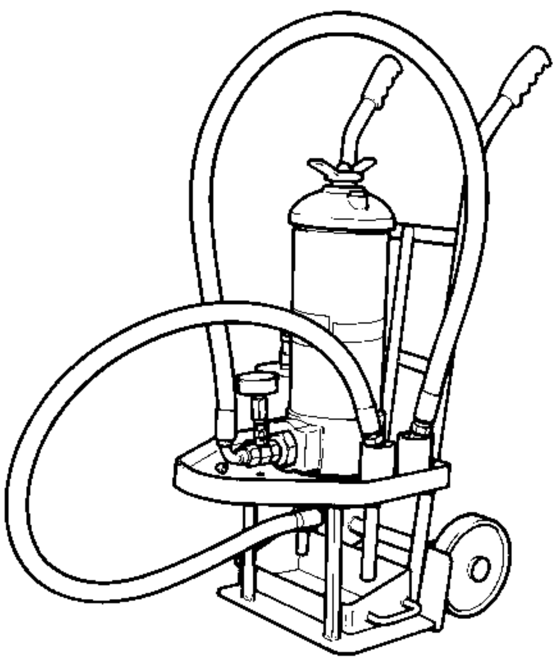
Smallest particle visible to the naked eye is 40 microns (0.00157) approximately.

Standards will often be quoted to ISO (International Standards Organisation) for which literature can be obtained.

Filters

The filter assembly fitted to all product ranges is designed to filter all the contamination that is generated through use to the required level of cleanliness. The filter must be serviced to the requirements of the machine Service Schedules.

To ensure optimum performance and reliability it is important that the machines hydraulic system is serviced periodicaly in accordance with the manufacturers requirements. For service schedules refer to Section 3 **Routine Maintenance -**



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Flow and Pressure Testing

Main Pump

The main hydraulic pump is mounted on the left side of the engine and driven from the power take off point below the injector pump. The unit supplies hydraulic fluid to the machine's main services circuit and also to the steering circuit via the priority valve.

If a hydraulic fault is suspected, check flow and pressure of the pump and the operation of the priority valve before removing and dismantling the unit.

As a pre-requisit to checking the flow and pressure of the pump, it is necessary to check the setting of the main relief valve (MRV), refer to **Pressure Testing - MRV**. Adjust if necessary.

⚠ WARNING

Hydraulic fluid at system pressure can injure you. Before disconnecting or connecting hydraulic hoses, stop the engine and operate the controls to release pressure trapped in the hoses. Make sure the engine cannot be started while the hoses are open.
INT-3-1-11/1

⚠ WARNING

Take care when disconnecting hydraulic hoses and fittings as the oil will be HOT.
TRANS 1-2

1 Switch off the engine and remove the starter key.

2 Relieve residual system pressure by operating the services controls a few times.

3 Disconnect the pump outlet hose **A**. Connect a flow meter (service tool 892/00268) and load valve (service tool 892/00270) in the line between the pump outlet port and the hose.

Note: Make sure the flow meter is installed with its arrow pointing away from the pump. Make sure the load valve is in the open position, i.e. with the adjusting knob screwed fully out.

4 Connect a 0-400 bar (0-6000 lbf/in^2) pressure gauge to the load valve pressure test point.

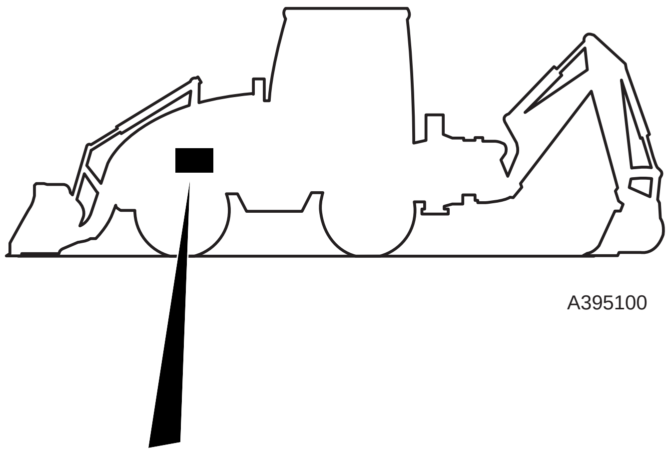
5 Start the engine and bring the hydraulics up to working temperature 50°C (122°F). Set the engine speed to 2000 rpm.

6 Carefully adjust the load valve to steadily increase the pressure so that the pressure gauge reads just below the MRV setting.

7 Observe the pressure and flow readings achieved, these should be as given in **Technical Data**.

8 If the flow is less than that specified replace the pump complete. DO NOT individually renew the gears or the housing as this will not effect a permanent cure.

9 When testing is complete repeat steps 1 and 2. Remove the flow meter, load valve and the pressure gauge from the line. Reconnect the pump outlet hose **A**.



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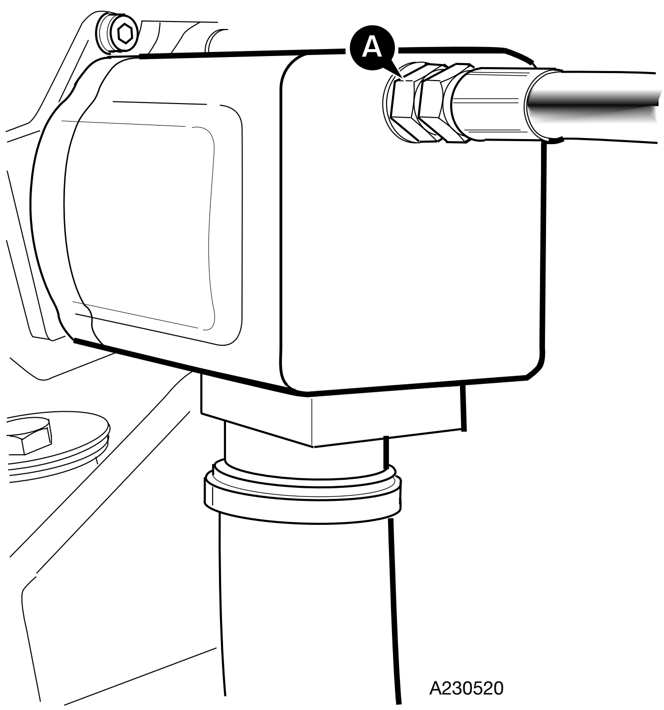

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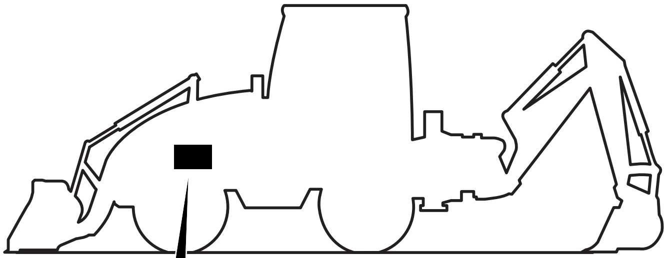
Flow and Pressure Testing

Auxiliary Pump

On some machines a second pump is mounted on the right side of the engine and driven by an auxiliary power take off. The unit supplies additional flow to the excavator valve.

If a hydraulic fault is suspected, check flow and pressure of the pump before removing and dismantling the unit.



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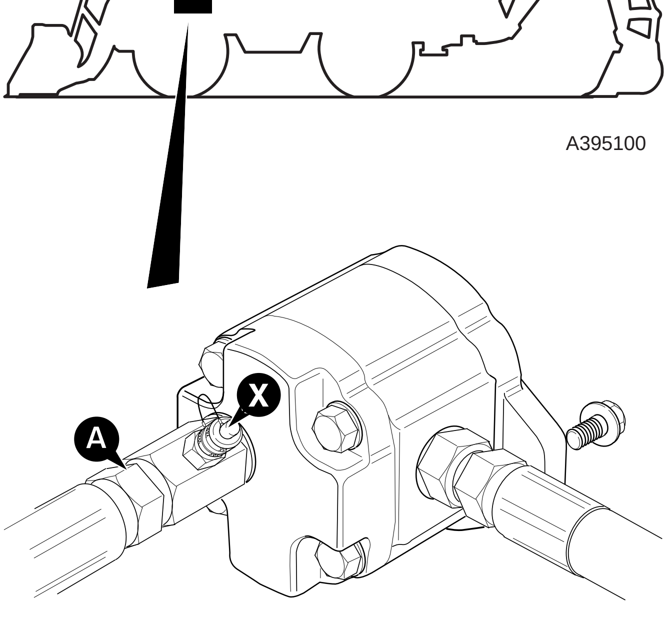

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⚠ WARNING

Hydraulic fluid at system pressure can injure you. Before disconnecting or connecting hydraulic hoses, stop the engine and operate the controls to release pressure trapped in the hoses. Make sure the engine cannot be started while the hoses are open.

INT-3-1-11/1

⚠ WARNING

Take care when disconnecting hydraulic hoses and fittings as the oil will be HOT.

TRANS 1-2

1. Switch off the engine and remove the starter key.

2. Relieve residual system pressure by operating the excavator controls a few times.

3. Disconnect the pump outlet hose from port **A.** Connect a flow meter (service tool 892/00268)and load valve (service tool 892/00270) in the line between the pump outlet port and the hose.

Note: Make sure the flow meter is installed with its arrow pointing away from the pump. Make sure the load valve is in the open position, i.e. with the adjusting knob screwed fully out.

4. Connect a 0-400 bar (0-6000 lbf/in^2) pressure gauge to the test point **X**.

5. Start the engine and bring the hydraulics up to working temperature 50°C (122°F). Set the engine speed to 2000 rpm.

6. Carefully adjust the load valve to steadily increase the pressure so that the pressure gauge reads just below the MRV setting.

7. Observe the pressure and flow readings achieved, these should be as given in **Technical Data**.

8. If the flow is less than that specified replace the pump complete. DO NOT individually renew the gears or the housing as this will not effect a permanent cure.

9. When testing is complete repeat steps 1 and 2. Remove the flow meter and the pressure gauge. Reconnect the pump outlet hose to port **A** and refit the blanking cap to test point **X.**

Pressure Testing

Main Relief Valve (M.R.V.) - In situ

The MRV is housed in the loader valve block. Make sure that the hydraulic oil is at working temperature, i.e. 50°C (122°F).

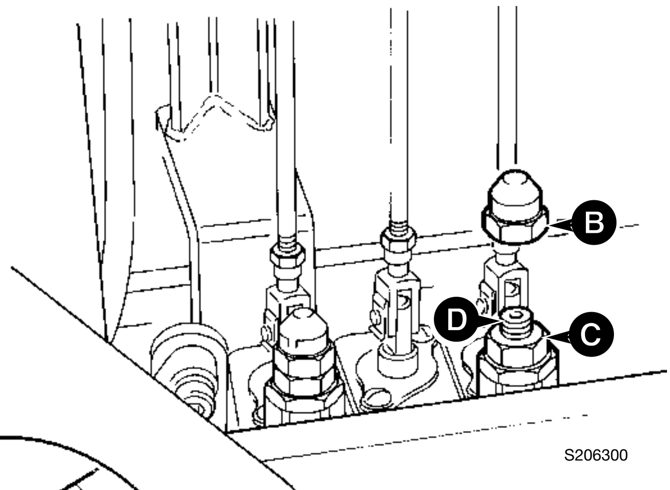
Lower the excavator bucket and loader shovel to rest on the ground; stop the engine; operate the control levers to vent residual hydraulic pressure.

1 Connect a 0 - 400 bar (0 - 6000 lbf/in^2) pressure gauge to test connector **A**, adjacent to the loader valve.

2 With the engine running at 1500 revs/min, check M.R.V. pressure by raising or lowering the loader arms until the rams are fully open or closed and noting the maximum gauge reading. **CAUTION**: Do not select 'float'. The maximum pressure should be as stated in **Technical Data.**

Note: The rams must be 'held' open or closed when reading gauge.

3 If the pressure is incorrect, remove dome nut **B**, slacken locknut **C** and adjust screw **D**. Turn it clockwise to increase pressure and anti-clockwise to decrease the pressure. When the pressure is correct, tighten the locknut.



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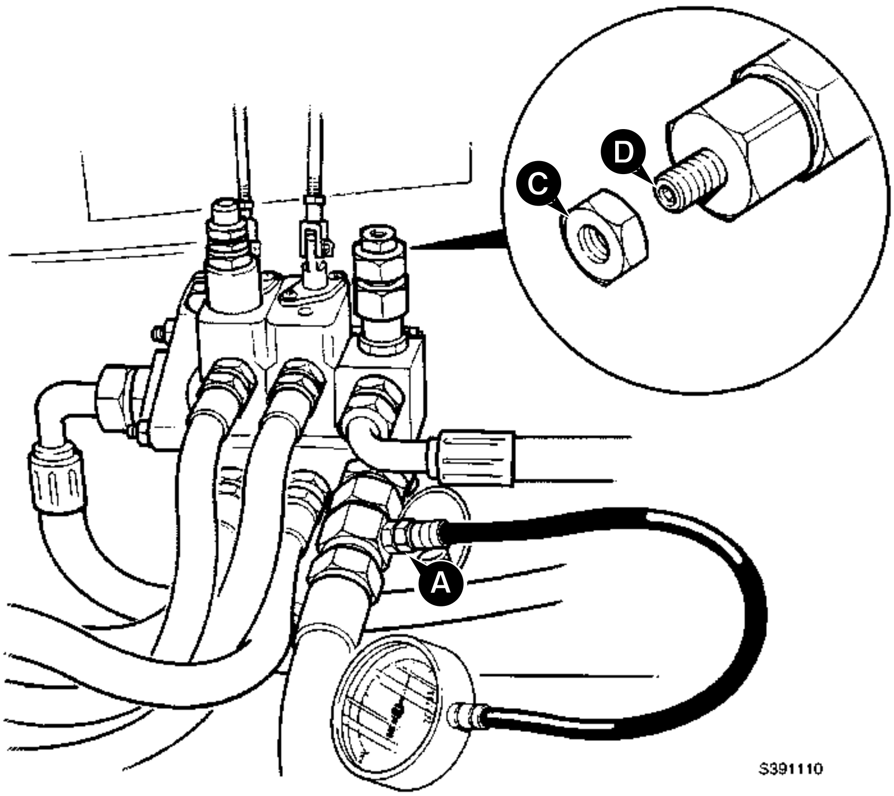

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Pressure Testing

Auxiliary Relief Valves (A.R.V's) - Using Hand Pump

Insert the A.R.V. into the test block (service tool 892/00252). Connect hand pump (service tool 892/00223) and a 0-400 bar (0-6000 lbf/in^2) pressure gauge.

Plug the two large diameter (3/4 inch B.S.P.) ports of the test block using blanking plugs (service tool 892/00059) and bonded washers (service tool 1406/0021).

Pressurise until oil begins to escape from the drain hole **D**. At this point the gauge will indicate the crack pressure of the A.R.V.

The pressure should be as given below.

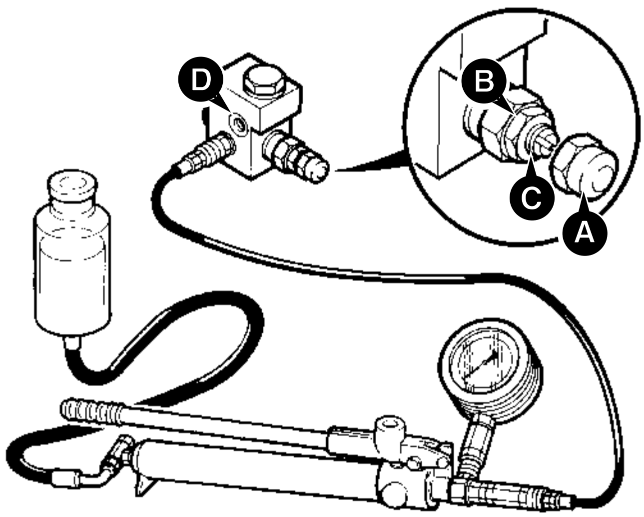
If required, adjust the pressure by removing dome nut **A**, slackening locknut **B** and turning screw **C**.

Relief Valve Test Pressures

Pilot-operated relief valves - 7 bar (102 lbf/in^2) below the operating pressure given in **Technical Data**.

Direct acting relief valves - 10 bar (145 lbf/in^2) below the operating pressure given in **Technical Data**.

Note: Refer to **Technical Data** for type of relief valve fitted to service.



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Quick Release Couplings - Connecting and Disconnecting

Flat face quick release couplings allow the operator to remove and install attachments swiftly and efficiently. Generally, your machine pipework will have female couplings **A** fitted, and the optional attachment hoses will have male couplings **B** fitted.

The quick release couplings should be trouble free and relatively easy to connect and disconnect, provided they are kept clean and used correctly. The recommendations listed below should always apply when using flat face quick release couplings.

Finally, please read the correct fitting and releasing procedures before installing or removing any optional attachment fitted with quick release couplings.

Quick Release Couplings - Do's & Don'ts

DO wipe the two faces of the coupling and make sure they are clean before connecting.

DO make sure the outside sleeve (female coupling) is pulled back when disconnecting.

DO connect and disconnect a new coupling two or three times to 'work' the PTFE seals - sometimes a new coupling will stick if the seals have not been 'worked'.

DO use a spanner on the hexagon flats of the coupling when fitting adaptors.

DO use a rubber or hide hammer to disconnect a coupling if it sticks - sticking may occur if there is dirt present in the coupling.

DON'T attempt to re-connect a damaged half coupling - this will destroy the seals and necessitate replacing both half couplings.

DON'T leave the coupling where it may be run over by a machine or otherwise crushed - this will distort the coupling sleeve and prevent correct connection and disconnection.

DON'T clamp on the smooth diameter of the coupling when fitting adaptors - always use the hexagon.

DON'T try to turn the sleeve (female coupling) when the coupling has been disconnected - the locking ball will wedge underneath the sleeve and destroy the coupling.

DON'T damage the faces of the couplings - this can prevent connection and disconnection, or damage seals and cause leakage.

DON'T try to dismantle the couplings - they are non serviceable parts. If a coupling is damaged it should be replaced with a new one.

⚠ WARNING

Hydraulic fluid at pressure can injure you. Make the machine safe before connecting or disconnecting quick release couplings; stop the engine and then operate the attachment control a few times to vent residual hydraulic pressure in the attachment hoses.

2-4-1-11

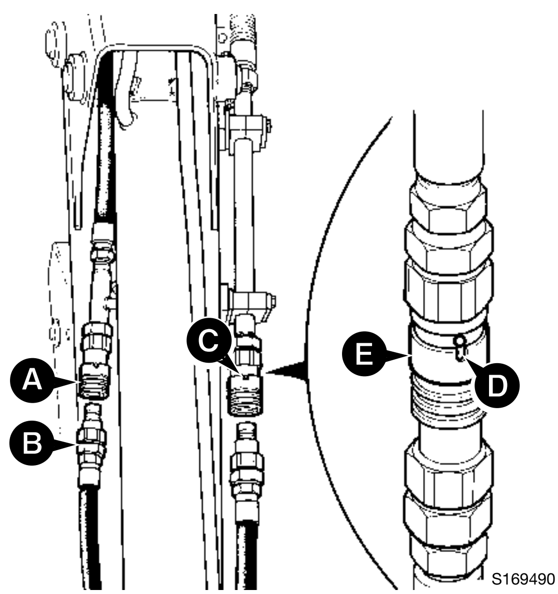
Before connecting or removing any hydraulic hose, residual hydraulic pressure trapped in the service hose line must be vented. This is usually achieved by switching off the engine and then operating the attachment control lever several times. Make sure the hose service line has been vented before connecting or removing hoses - refer to the appropriate attachment information in this section.

Connecting Quick Release Couplings

1. Remove any residual hydraulic pressure trapped in the service line hose.
2. Wipe the two faces of the male and female couplings and make sure they are clean.
3. Make sure that ball **C** in the female coupling is located in one of its slots.
4. Fit the male coupling into the female coupling; To ensure that the coupling is not accidentally released, rotate sleeve **E** half a turn and make sure that the locking ball **C** does not align with the slot **D**.

Disconnecting Quick Release Couplings

1. Remove any residual hydraulic pressure trapped in the service line hose.
2. Align the slot **D** with ball **C**.
3. Pull back sleeve **E** to release the coupling.



Smooth Ride System

Charging/Discharging the Accumulator

Charging

1 Park the machine on level ground, lower the loader arms, switch off the engine and chock all four wheels. Release all hydraulic pressure in the accumulator by selecting the starter key to the ON position without the engine running, SRS ON and operating the loader arm hydraulic lever.

2 Remove gas valve guard **A** and gas valve cap **B**.

3 Screw T handle **C** all the way out (counter clockwise) before attaching charging tool (service tool 892/00948) to accumulator gas valve.

4 Close bleed valve **D**.

5 Making sure not to loop or twist the hose, connect the charging tool to the gas valve. Tighten to 1.0 lbf ft (1.36 Nm, 0.14 kgf m).

6 Connect charging tool to a bottle of compressed nitrogen gas.

7 Screw T handle **C** all the way in (clockwise), this will depress the core in the gas valve. Check charge pressure which should be set to suit the loader and the attachment fitted to the machine. For recommended charge pressures refer to **Technical Data - Smooth Ride System**.

8 If charge pressure is low, carefully open hand valve **E** on the nitrogen bottle and SLOWLY fill the accumulator. Close valve **E** when the required charge pressure is reached on the gauge.

9 Let the pressure settle for 10 to 15 minutes. This will allow the gas temperature to stabilise. If the charge pressure is exceeded, with the gas bottle closed, open bleed valve **D.** Reduce pressure as required, then close bleed valve.

⚠ CAUTION

To reduce pressure use the recommended charging tool or the charge valve could be damaged which may result in rapid discharge of the accumulator.
HYD 2-4

10 When complete screw T handle **C** all the way out (counter clockwise) then open the bled valve **D** to vent the hose.

11 Hold the gas valve to keep from turning, loosen nut and remove charging tool.

12 Refit gas valve cap and valve guard.

Discharging

1 Park the machine on level ground, lower the loader arms, switch off the engine and chock all four wheels. Release all hydraulic pressure in the accumulator by selecting the starter key to the ON position without the engine running, SRS ON and operating the loader arm hydraulic lever.

2 Remove gas valve guard **A** and gas valve cap **B**.

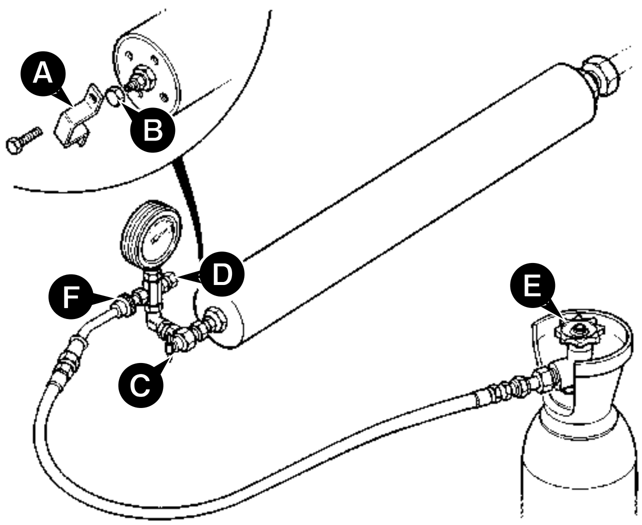
3 Screw T handle **C** all the way out (counter clockwise) before attaching charging tool (service tool 892/00948) to accumulator gas valve.

4 Close bleed valve **D**.

5 Either connect charging tool to a bottle of compressed nitrogen gas which is turned off or remove hose **F** and fit a suitable blank on charging tool.

6 Screw T handle **C** all the way in (clockwise), this will depress the core in the gas valve.

7 Open bleed valve **D** until all the gas charge is relieved from the accumulator. Remove the charging tool.



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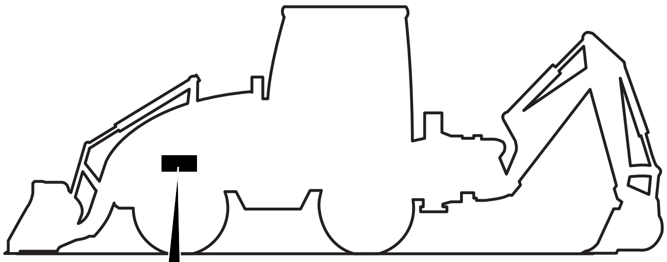
Removal and Replacement

Before removing and dismantling the pump, check flow and pressure. If either of these are low and cannot be corrected at the relief valve, the pump must be renewed completely. Renewal of components such as gears, bearings and housing will not effect a permanent cure. If the pump output is satisfactory but there is external leakage, the pump should be removed and dismantled for re-sealing only.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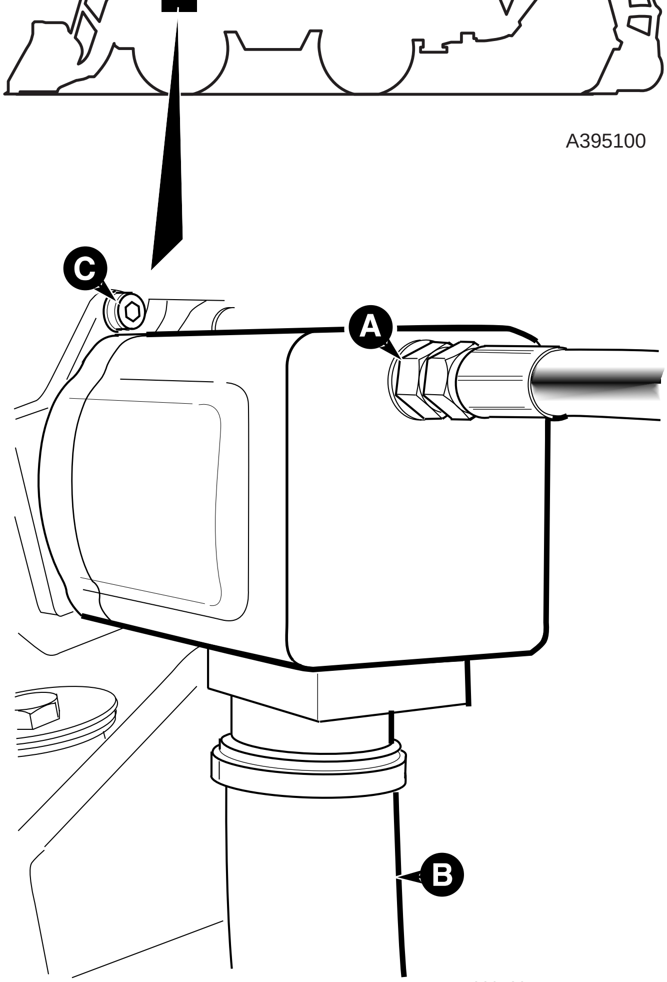
Removal

⚠ WARNING

Raised loader arms can drop suddenly and cause serious injury. Before working under raised loader arms, fit the loader arm safety strut.
GEN 3-2



A230520

1 Raise the loader arms and fit the loader arm safety strut. If hydraulic pressure is not available, select 'lift arms raise' on control lever whilst lifting arms with a suitable hoist.

2 Disconnect the battery.

3 Open the left hand side engine panel.

⚠ WARNING

Make the machine safe before getting beneath it. Ensure that any fitments on the machine are secure; engage the parking brake, remove the starter key, disconnect the battery.
INT-3-3-8

4 Operate the controls to vent residual pressure.

5 Disconnect and plug outlet hose **A**.

6 Disconnect and plug inlet hose **B**.

7 Undo bolts **C**, remove pump from machine.

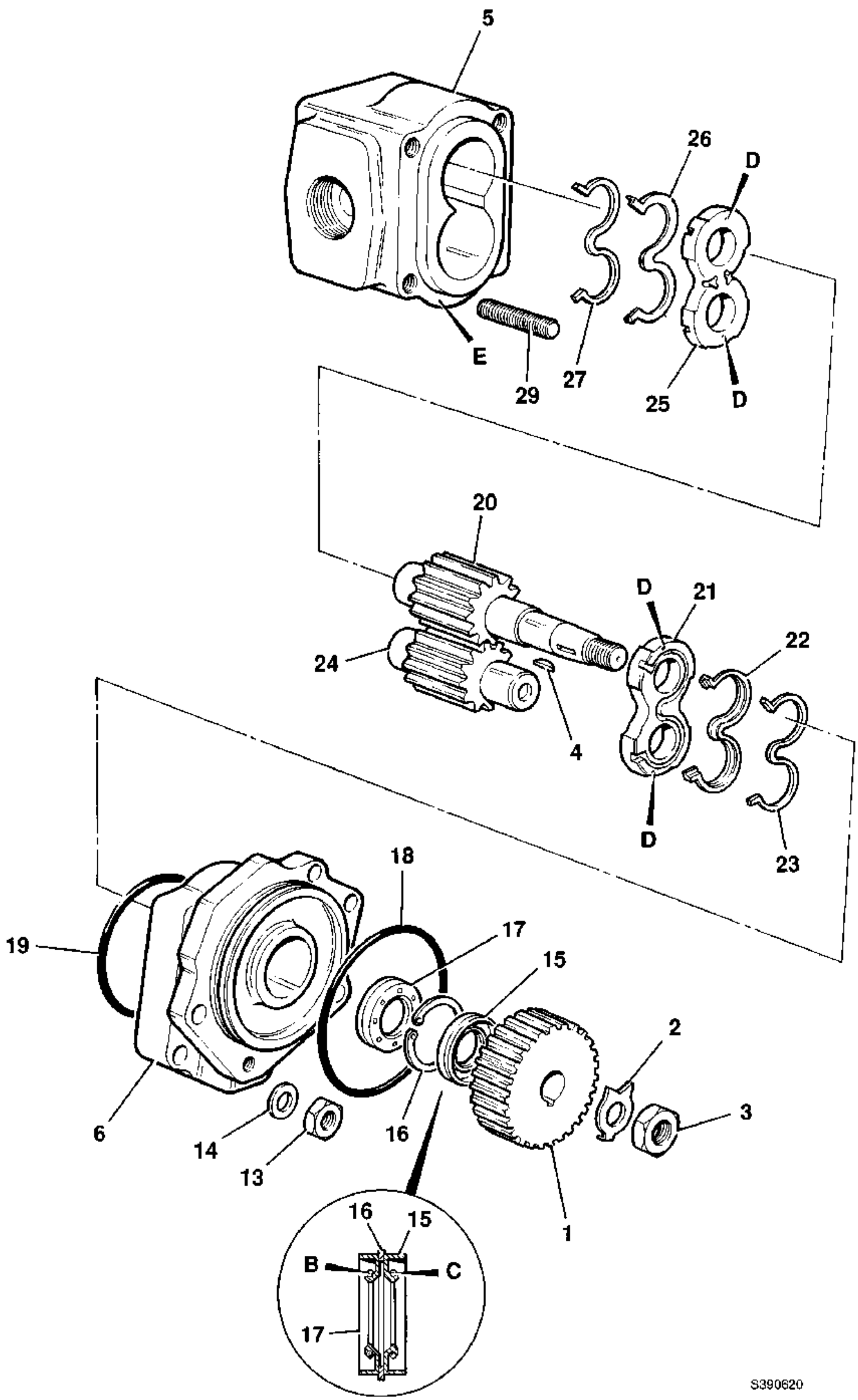
Replacement

Replacement is a reversal of the removal procedure.

1 Use a new gasket between pump and engine.

2 After fitting a new or serviced pump and before starting the engine screw the MRV out 4 full turns, and carry out the MRV setting procedure, refer to **Service Procedures, Pressure Testing - MRV**.

For dismantling and assembly procedure refer to **Main Pump - Dismantling and Assembly**.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S390620

Dismantling and Assembly

Before removing and dismantling the pump, check flow and pressure. If either of these are low the pump must be changed. Renewal of components such as gears, bearings and housing will not effect a permanent cure. If the pump output is satisfactory but there is external leakage, the pump should be removed and dismantled for re-sealing only.

Before removing and dismantling the pump, make sure the exterior of the pump and working area is thoroughly cleaned and free of possible sources of contamination.

Dismantling

1 Remove drive gear **1** and key **4** using a suitable puller, do not lever or hammer as this will result in internal damage to the pump.

2 Remove sharp edges and burrs from the shaft to avoid seal damage.

3 Mark body **5** and flange **6** to ensure correct assembly.

4 Undo nuts **13** and separate body **5** from flange **6**, slide the flange off square to the shaft. Take care not to damage machined faces by prising them apart - use a soft faced hammer.

5 Use a drift to remove the outer shaft seal **15**, then remove circlip **16** and inner shaft seal **17**. Take care not to damage the shaft seal recess.

6 Remove drive shaft **20** and balance plate **21** then remove driven gear **24** and balance plate **25**. Note the positions of balance plates **21** and **25** to ensure correct assembly.

Inspecting

1 Remove and discard all seals. Remove sealant from flange **6** and body **5**.

2 Inspect 'O' ring groove and shaft seal recess in mounting flange **6**, make sure there is no damage and is free of burrs.

3 Check that the mating faces on the mounting flange **6** and body **5** are not scored.

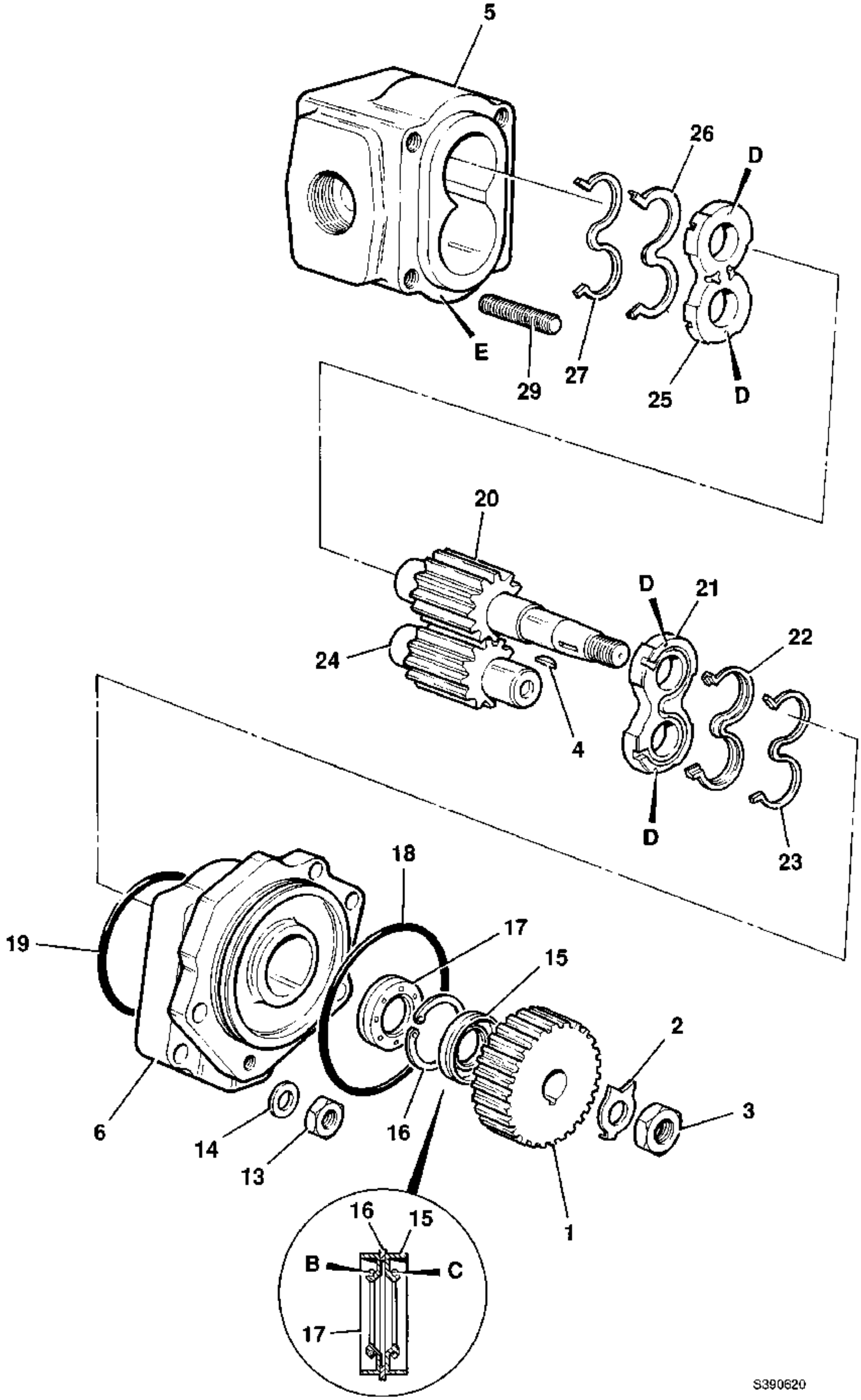
The pump must be renewed if:-

The PTFE coated bearings in the body or flange are worn through so that the bronze base is visible.

The gear side faces or balance plates are scored.

The drive shaft has a wear groove where the shaft seal lips run.

For **Assembling** see next page.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S390620

Dismantling and Assembly

Assembling

1 Wash all components and apply hydraulic oil immediately afterwards to prevent moisture collecting.

2 Renew all seals and 'O' rings using JCB Special Hydraulic fluid as a lubricant.

3 Fit inner shaft seal **17** into mounting flange **6** with the garter spring **B** facing toward the pump.

4 Fit circlip **16** and outer shaft seal **15** with garter spring **C** facing away from the pump. Coat seal lips with JCB HP grease.

5 Fit seal **26** and back up seal **27** to balance plate **25**, locate assembly into main body **5**.

Note: Make sure that the two small holes **D** in the balance plate are on the low pressure side of the pump, i.e. the side adjacent to the threaded inlet port.

6 Fit drive shaft **20** and driven gear **24** into their original bores.

7 Fit seal **22** and back up seal **23** to balance plate **21**, locate assembly over drive shaft **20** and driven gear **24**.

Note: Make sure that the two small holes **D** in the balance plate are on the low pressure side of the pump, i.e. the side adjacent to the threaded inlet port.

8 Fit 'O' ring **19** to mounting flange **6**. Apply a small amount of JCB Multi-gasket to main body mating face, shown at **E**.

9 Fit protective sleeve over driveshaft, locate mounting flange to main body in its original position, drain hole to low pressure side i.e. the side with the threaded inlet port.

10 Secure with washers **14** and nuts **13**, torque load.

11 Pour a small amount of clean hydraulic oil into the inlet port and check that the drive shaft can be turned by hand without undue force.

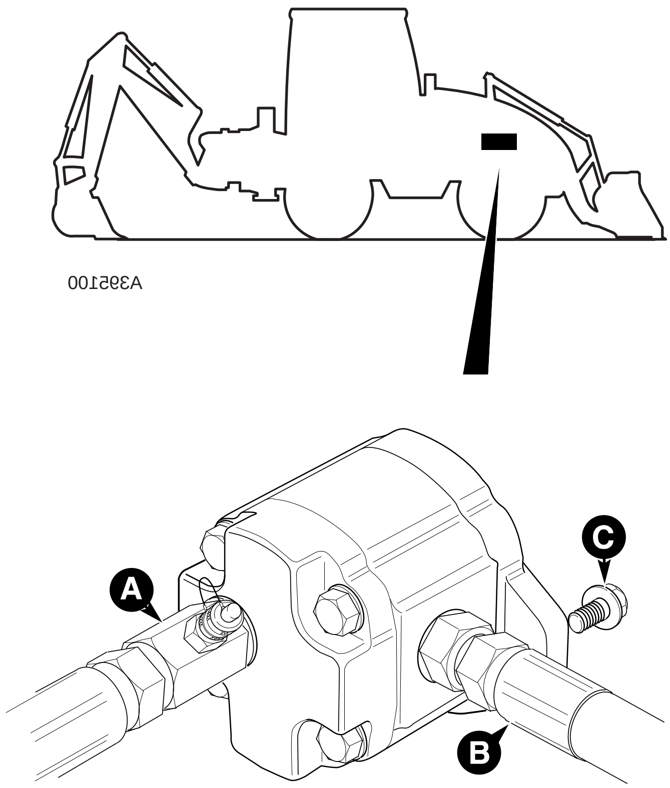
12 Fit key **4**, drive gear **1**, tab washer **2** secure with nut **3**. Torque load nut **3** and lock with tab.

Torque Settings

Item	Nm	Kgf. m	lbf. ft
3	100	10	74
13	95	9.7	70

Removal and Replacement

Before removing and dismantling the pump, check flow and pressure. If either of these are low and cannot be corrected at the relief valve, the pump must be renewed completely. Renewal of components such as gears, bearings and housing will not effect a permanent cure. If the pump output is satisfactory but there is external leakage, the pump should be removed and dismantled for re-sealing only.



Removal

⚠ WARNING

Raised loader arms can drop suddenly and cause serious injury. Before working under raised loader arms, fit the loader arm safety strut.

GEN 3-2

1 Raise the loader arms and fit the loader arm safety strut. If hydraulic pressure is not available, select 'lift arms raise' on control lever whilst lifting arms with a suitable hoist.

2 Disconnect the battery.

3 Open the right hand side engine panel.

⚠ WARNING

Make the machine safe before getting beneath it. Ensure that any fitments on the machine are secure; engage the parking brake, remove the starter key, disconnect the battery.

INT-3-3-8

4 Operate the controls to vent residual pressure.

5 Disconnect and plug outlet hose **A**.

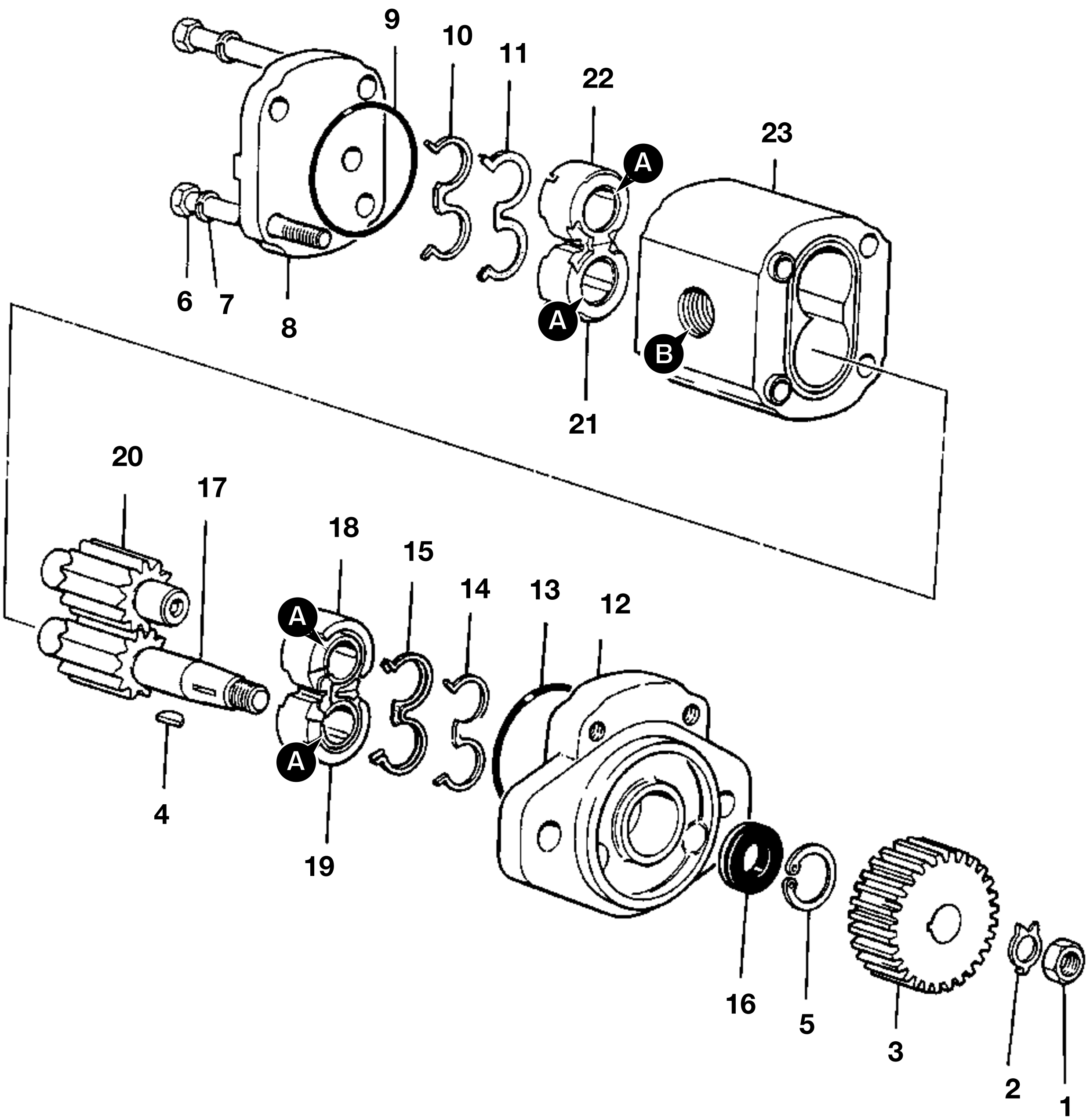
6 Disconnect and plug inlet hose **B**.

7 Undo bolts **C**, remove pump from machine.

Replacement

Replacement is a reversal of the removal procedure.

For dismantling and assembly procedure refer to **Auxiliary Pump - Dismantling and Assembly**.



S230540

Dismantling and Assembly

Before dismantling/assembling make sure that the exterior surfaces of the unit and the working area are spotlessly clean.

Dismantling

1 Make relative location marks on pump body **23**, mounting flange **12** and cover **8** to ensure their correct positioning during assembly.

2 Dismantle in the numerical order shown on the illustration opposite, bearing in mind the following points:
- **a** DO NOT prise apart any machined faces. Always use a soft faced hammer to avoid damaging the surfaces.
- **b** Mark bushes **18, 19, 21** and **22** on a plain area away from the seals so that they are returned to their original location during assembly.
- **c** Remove drive shaft **17** with bushes **18** and **19** as an assembly, and gear **20** with bushes **21** and **22** as an assembly.
- **d** Discard all seals.

Inspection

1 Generally check all pump parts for damage and/or wear. Renew the pump if:
- **a** There is more than minor damage to the grooves in pump body **23** where 'O' rings **9** and **13** locate.
- **b** The recess for seal **16** in mounting flange **12** is scored.
- **c** There is a noticeable wear groove on shaft **17** where the lips of seal **16** runs.
- **d** The track cut by the gear in the inlet side of pump body **23** is deeper than 0.08 mm (0.003 in) or has a scored matt finish.
- **e** The side faces of gears **17** and **20** and/or the inner faces of bushes **18**,**19**, **21**, **22** are scored.
- **f** The bores **A** of bushes **18**,**19**, **21**, **22** are worn to the extent that the bronze backing is visible through the grey P.T.F.E. coating.

2 Remove any burrs and sharp edges from the shaft of gear **17** to avoid causing damage to seal **16** on assembly.

Assembling

Wash all components and apply hydraulic oil immediately to prevent corrosion.

Renew all seals and 'O' rings. Lubricate using JCB Special Hydraulic Fluid.

For ease of assembly proceed as follows:

1 Fit bushes **21** and **22** into the undowelled end of pump body **23**, making sure the grooves for seals **10** and **11** face outwards.

2 Locate cover **8** against pump body **23**. Stand the assembled components on the cover, i.e. with the pump body dowels uppermost.

3 Fit drive shaft **17** and gear **20** in their original positions in the pump body, followed by bushes **18** and **19** with their seal grooves outwards. Fit new seals **14** and **15**.

4 Fit a new 'O' ring **13** into the groove in pump body **23**. Fit a new shaft seal **16**, garter spring facing into the flange, followed by circlip **5**. Coat the lips of the seal with high melting point grease.

5 Carefully refit mounting flange **12**, ensuring a square fit on the pump body dowels.

6 Turn over the assembly and support it on the mounting flange, making sure there is no weight placed on the drive shaft.

7 Lift off cover **8**. Fit new seals **10** and **11** and a new 'O' ring **9** to pump body **23**.

8 Replace the valve cover and install the bolts **6** with their spring washers **7**. Progressively and evenly torque tighten the bolts.

9 Pour a small amount of clean hydraulic fluid into port **B** and check that the drive shaft rotates without undue force.

10 If the check at step 9 is satisfactory, fit items **4**, **3**, **2** and **1**. Use a new key **4**.

Torque Setting

Item	Nm	kgf m	lbf ft
1	88-102	9-14	65-75

Removal and Replacement

WARNING

Make the machine safe before working underneath it. Park the machine on level ground, lower the arms. Apply the parking brake, put the transmission in neutral and stop the engine. Chock both sides of all four wheels.

Disconnect the battery, to prevent the engine being started while you are beneath the machine.

GEN-1-2

DANGER

Hydraulic Pressure

Hydraulic fluid at system pressure can injure you. Before disconnecting or connecting hydraulic hoses, stop the engine and operate the controls to release pressure trapped in the hoses. Make sure the engine cannot be started while the hoses are open.

INT-3-1-11/1

Removal

1 Operate the valve block levers back and forth to vent residual pressure.

2 Remove clevis pins **A** to disconnect the control levers from the valve block spools.

3 Disconnect all hydraulic hoses from the valve block and plug all orifices to prevent ingress of dirt. Label each hose before disconnecting, this will ensure correct position when refitting.

4 Loosen and remove bolts **B**, spring washers and plain washers. Remove the loader valve.

Replacement

Replacement is a reversal of the removal sequence.

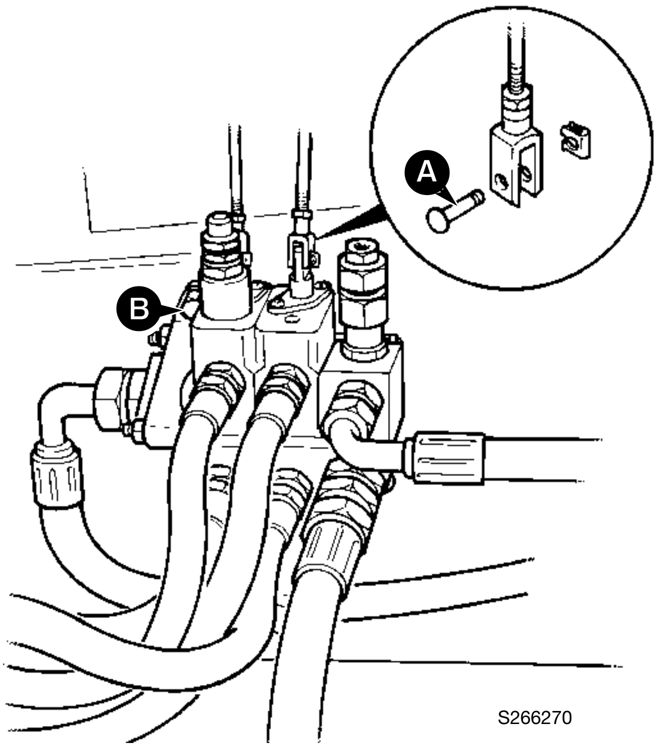
WARNING

Fine jets of hydraulic fluid at high pressure can penetrate the skin. Do not use your fingers to check for hydraulic fluid leaks. Do not put your face close to suspected leaks. Hold a piece of cardboard close to suspected leaks and then inspect the cardboard for signs of hydraulic fluid. If hydraulic fluid penetrates your skin, get medical help immediately.

INT-3-1-10/1

After replacement check the main relief valve (M.R.V.) and auxiliary relief valve (A.R.V.) pressure settings, refer to **Service Procedures, Pressure Testing - MRV and ARV's**.

Note: All hydraulic adapters that are installed together with a bonded sealing washer must also have JCB Threadseal applied to the threads of the adapter.



S266270

Dismantling and Assembly

Main Relief Valve (MRV)

The numerical sequence shown on the illustration is intended as a guide to dismantling.

For assembly the sequence should be reversed.

Great care should be taken when dismantling and assembling a valve to avoid the following:-

Contamination
Damage to spools
Damage to seal grooves

Any of the above may result in possible problems with the operation of the valve.

When Dismantling

When removing 'O' Rings and seals, use an appropriatly rounded tool that WILL NOT cause any damage to the seal grooves.

Discard ALL 'O' Rings and back-up rings. DO NOT use worn or damaged items.

Inspection

Inspect the valve components for scratches, nicks or any other type of damage, replace with new if required.

When Assembling

Renew all 'O' rings and back-up rings.

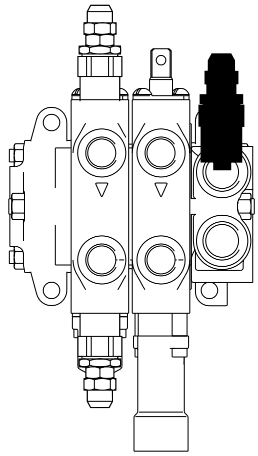
Lubricate parts with JCB Hydraulic Fluid before assembling. Make sure that all the parts move freely.

Make sure that the ‘O’ rings and back-up rings are fitted the correct way, items **10** and **11**.

Adjust pressure setting as required, refer to **Service Procedures, Pressure Testing - MRV and ARV’s**.

Torque Settings

Item	Nm	kgf m	lbf ft
3	5.4	0.6	4



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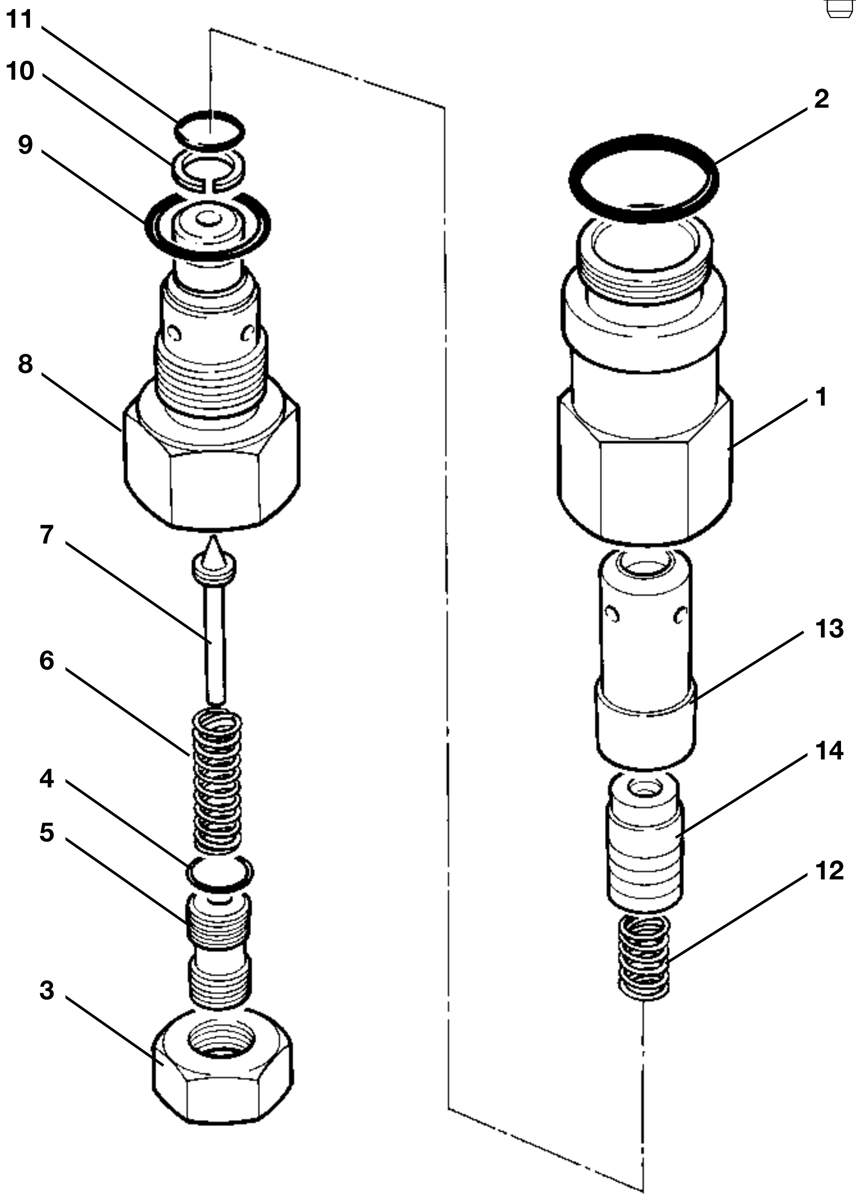

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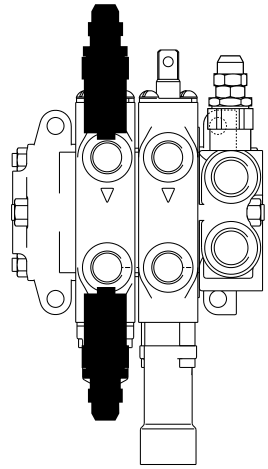
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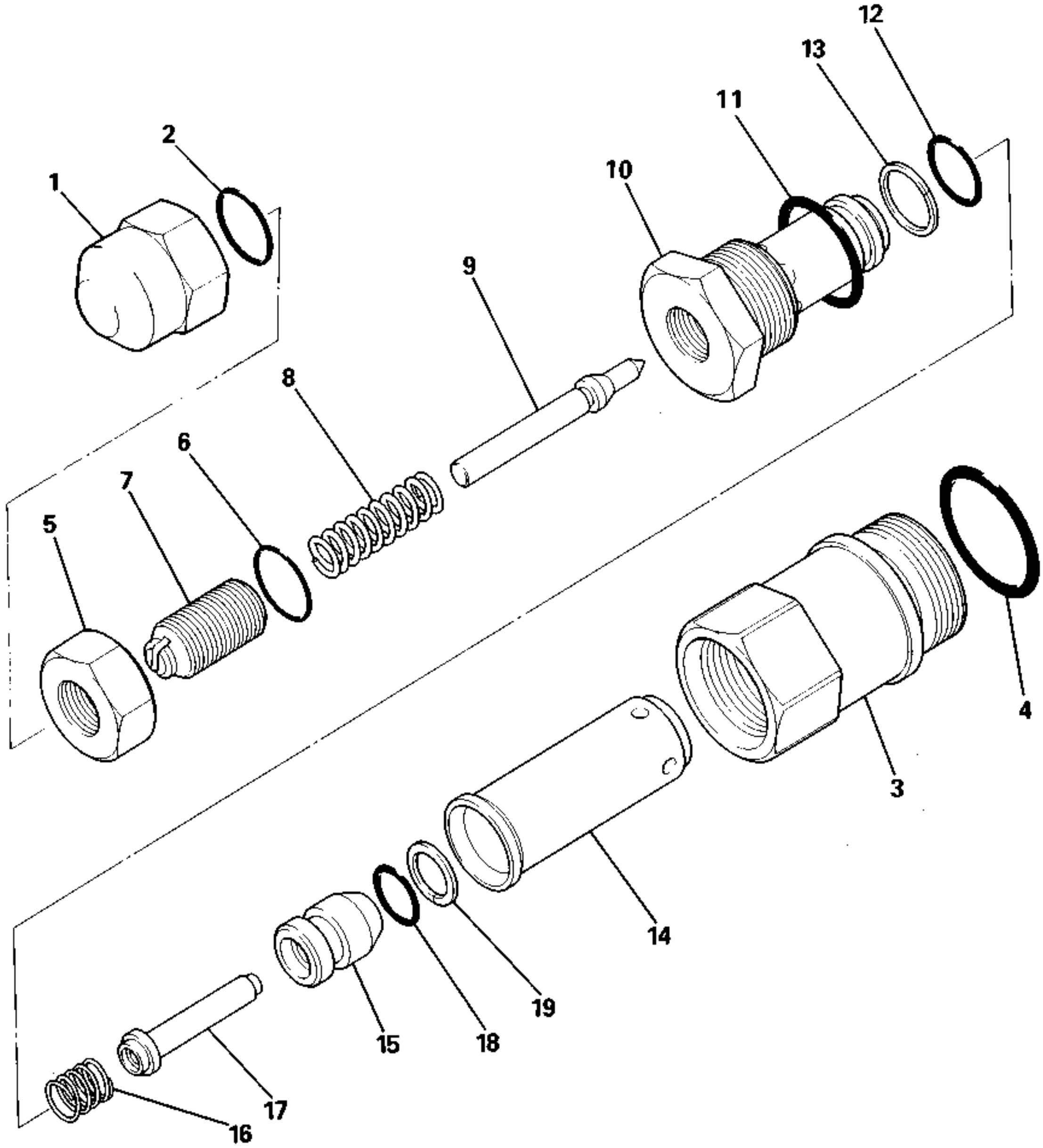
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Dismantling and Assembly

Auxiliary Relief Valve (ARV)

The numerical sequence shown on the illustration is intended as a guide to dismantling.

For assembly the sequence should be reversed.

Great care should be taken when dismantling and assembling a valve to avoid the following:-

Contamination
Damage to spools
Damage to seal grooves

Any of the above may result in possible problems with the operation of the valve.

When Dismantling

When removing 'O' Rings and seals, use an appropriatly rounded tool that WILL NOT cause any damage to the seal grooves.

Discard ALL 'O' Rings and back-up rings. DO NOT use worn or damaged items.

Inspection

Inspect the valve components for scratches, nicks or any other type of damage, replace with new if required.

When Assembling

Renew all 'O' rings and back-up rings.

Lubricate parts with JCB Hydraulic Fluid before assembling. Make sure that all the parts move freely.

Make sure that the ‘O’ rings and back-up rings are fitted the correct way, items **12, 13** and **18, 19**.

Adjust pressure setting as required, refer to **Service Procedures, Pressure Testing - MRV and ARV’s**.

Torque Settings

Item	**Nm**	**kgf m**	**lbf ft**
1	5.4 - 8.2	0.55 - 0.83	4 - 6
3	41 - 68	4.15 - 6.9	30 - 50
5	5.4 - 8.2	0.55 - 0.83	4 - 6
10	41 - 68	4.15 - 6.9	30 - 50

Dismantling and Assembly

Standard Spool

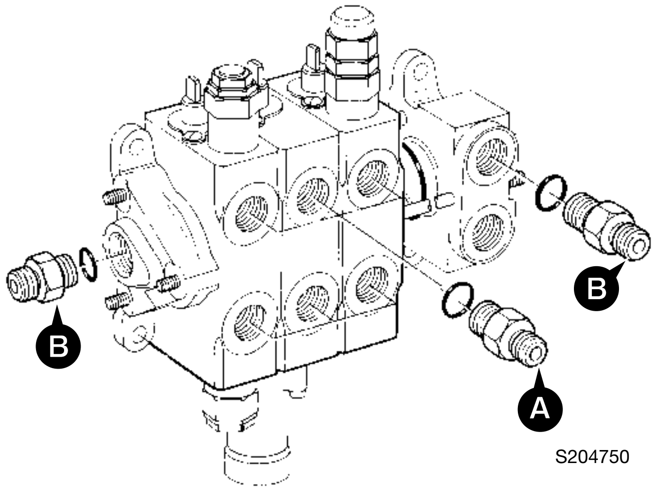
The numerical sequence shown on the illustration is intended as a guide to dismantling.

For assembly the sequence should be reversed.

Great care should be taken when dismantling and assembling a valve to avoid the following:-

Contamination
Damage to spools
Damage to seal grooves

Any of the above may result in possible problems with the operation of the valve.



Dismantling

When removing 'O' Rings and seals, use an appropriatly rounded tool that WILL NOT cause any damage to the seal grooves.

Discard ALL 'O' Rings. DO NOT use worn or damaged items.

Inspection

Inspect the valve components for scratches, nicks or any other type of damage, replace with new if required.

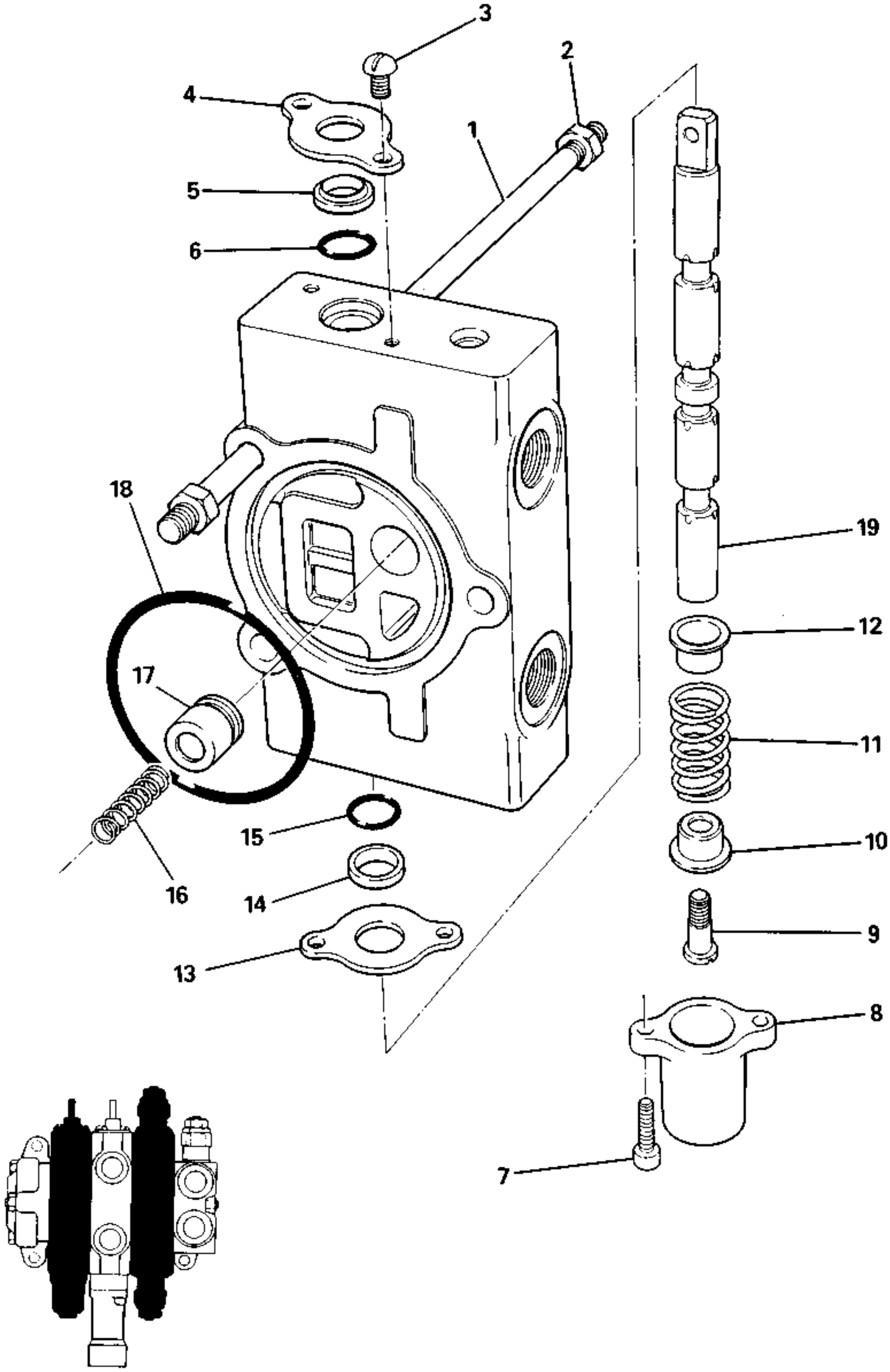
Assembly

Renew wipers **5** and **14** and 'O' rings **6**, **15** and **18**.

Torque Settings

Item	Nm	kgf m	lbf ft
7	6.1 - 7.5	0.62 - 0.76	4.5 - 5.5
9	9.5 - 10.9	0.97 - 1.11	7 - 8

Note: All valve block adapters, items **A** and **B** are torqued to 81 Nm (60 lbf ft; 8.3 kgf m).



S391170

Dismantling and Assembly

Float Spool

The numerical sequence shown on the illustration is intended as a guide to dismantling.

For assembly the sequence should be reversed.

Great care should be taken when dismantling and assembling a valve to avoid the following:-

Contamination
Damage to spools
Damage to seal grooves

Any of the above may result in possible problems with the operation of the valve.

Dismantling

When removing 'O' Rings and seals, use an appropriatly rounded tool that WILL NOT cause any damage to the seal grooves.

Discard ALL 'O' Rings. DO NOT use worn or damaged items.

Remove retainer **7** and spacer **8**. Using a suitable tool on ball **12**, compress spring **13** and allow detent balls **11** to roll into their holes in the detent pin **14**. Carefully remove the spool cap **10** and collect detent balls **11.**

Inspection

Inspect the valve components for scratches, nicks or any other type of damage, replace with new if required.

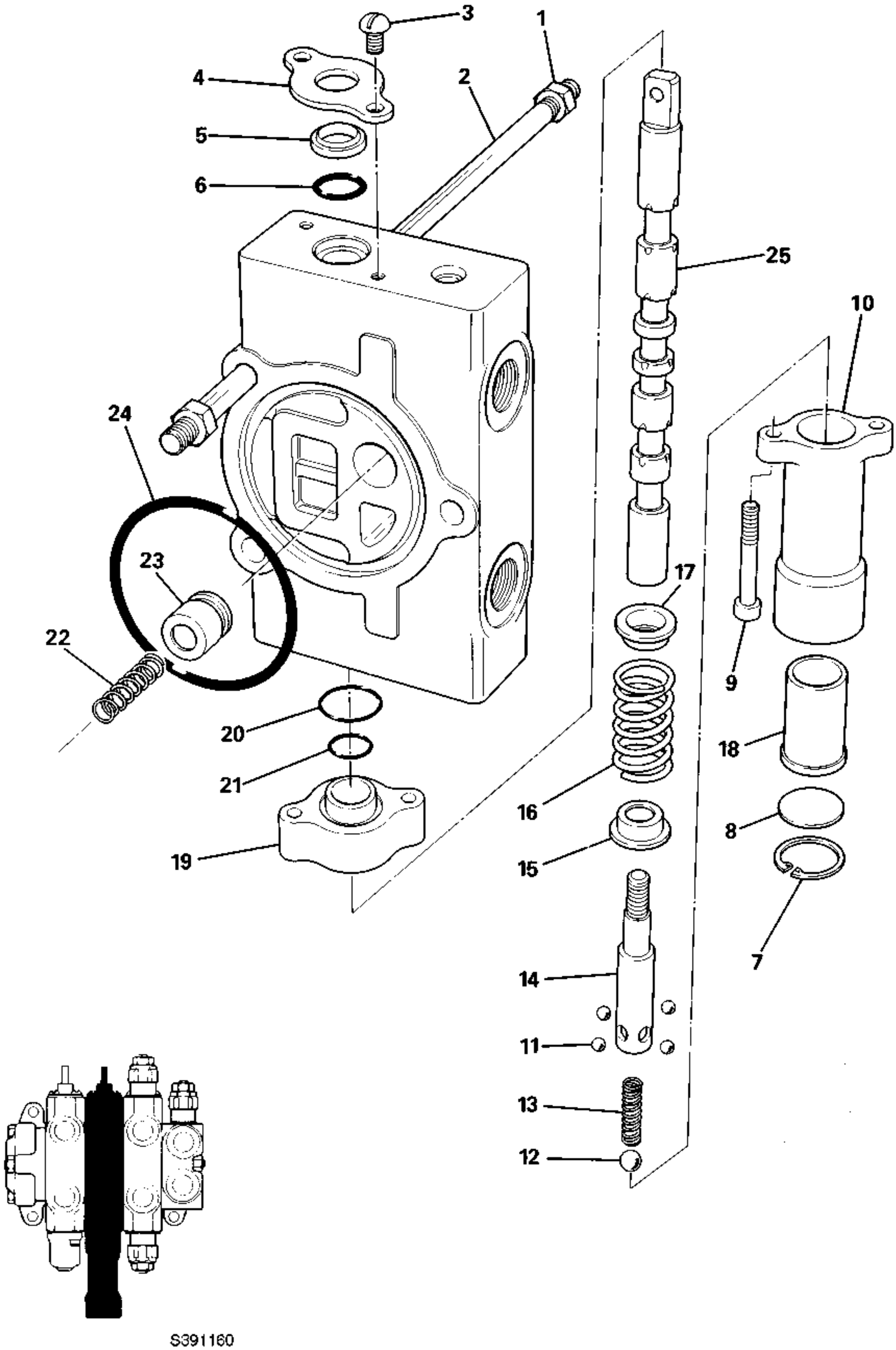
Assembly

Renew wiper **5** and 'O' rings **6**, **20, 21** and **24.**

Apply grease liberally to detent pin **14** to hold detent balls **11** in position during assembly and to provide lubrication.

Torque Settings

Item	Nm	kgf m	lbf ft
9	6.1 - 7.5	0.62 - 0.76	4.5 - 5.5
14	9.5 - 10.9	0.97 - 1.11	7 - 8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S391160

Removal and Replacement

⚠ WARNING

Make the machine safe before working underneath it. Park the machine on level ground, lower the arms. Apply the parking brake, put the transmission in neutral and stop the engine. Chock both sides of all four wheels.

Disconnect the battery, to prevent the engine being started while you are beneath the machine.

GEN-1-2

⚠ DANGER

Hydraulic fluid at system pressure can injure you. Before disconnecting or connecting hydraulic hoses, stop the engine and operate the controls to release pressure trapped in the hoses. Make sure the engine cannot be started while the hoses are open.

INT-3-1-11/1

Removal

1. Operate the valve block levers back and forth to vent residual pressure.

2. Remove the clevis pin **C** and discaonnect the hydra-clamp control rod.

3. Remove clevis pins **A** to disconnect the control levers from the valve block spools.

4. Disconnect all hydraulic hoses from the valve block and plug all orifices to prevent ingress of dirt. Label each hose before disconnecting, this will ensure correct position when refitting.

5. Loosen bolts **B** - do not completely remove the retaining bolts.

6. Make sure that the valve assembly is safely supported and then remove the bolts **B**.

7. Lift the valve assembly away from the chassis mounting lugs **D** and then lower it to the ground.

Replacement

Replacement is a reversal of the removal sequence.

Hoses and pipes (when applicable) must be re-connected and phased in same position as removal.

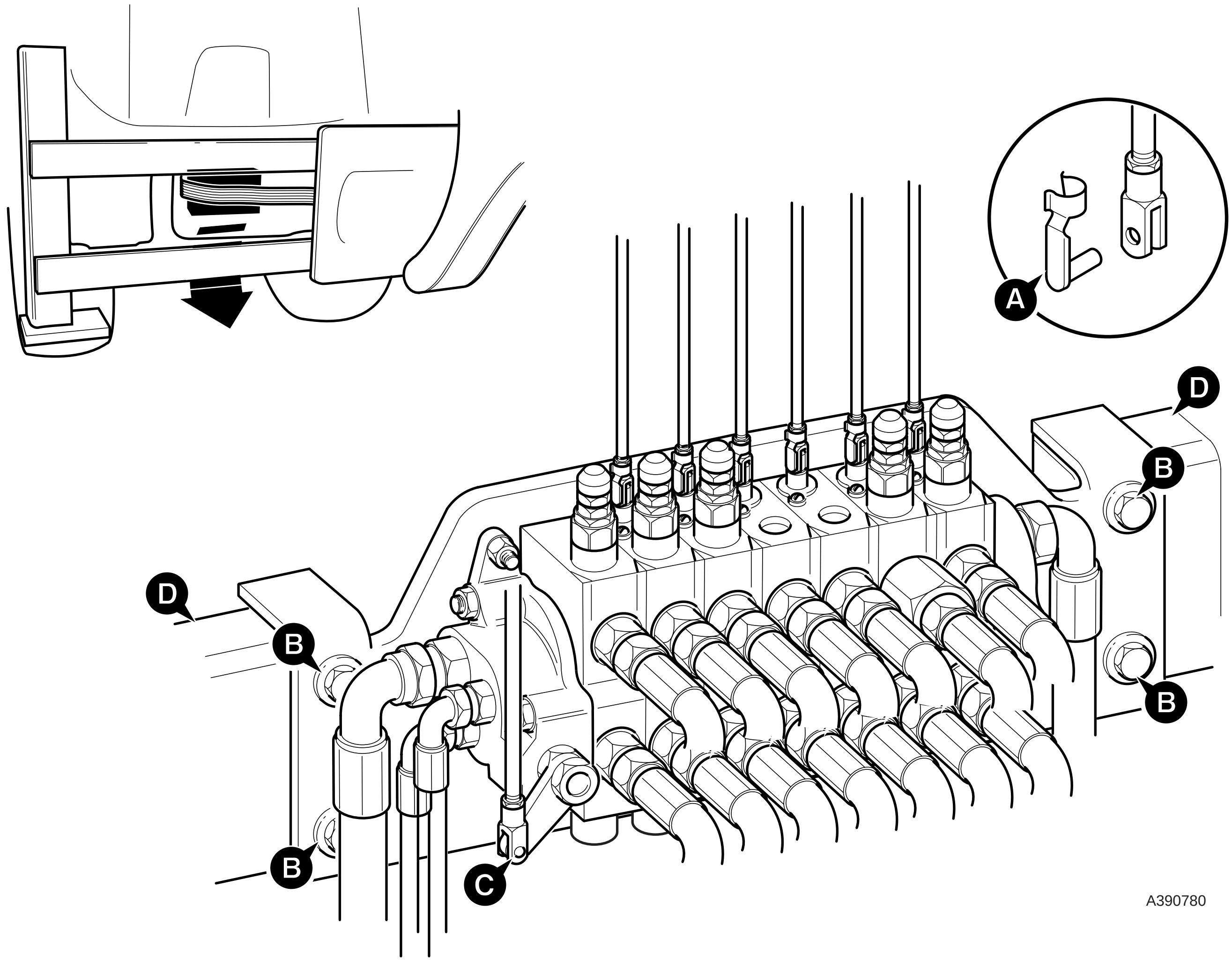
⚠ WARNING

Fine jets of hydraulic fluid at high pressure can penetrate the skin. Do not use your fingers to check for hydraulic fluid leaks. Do not put your face close to suspected leaks. Hold a piece of cardboard close to suspected leaks and then inspect the cardboard for signs of hydraulic fluid. If hydraulic fluid penetrates your skin, get medical help immediately.

INT-3-1-10/1

After replacement check the auxiliary relief valve (A.R.V.) pressure settings.

Note: All hydraulic adapters that are installed together with a bonded sealing washer must also have JCB Threadseal applied to the threads of the adapter.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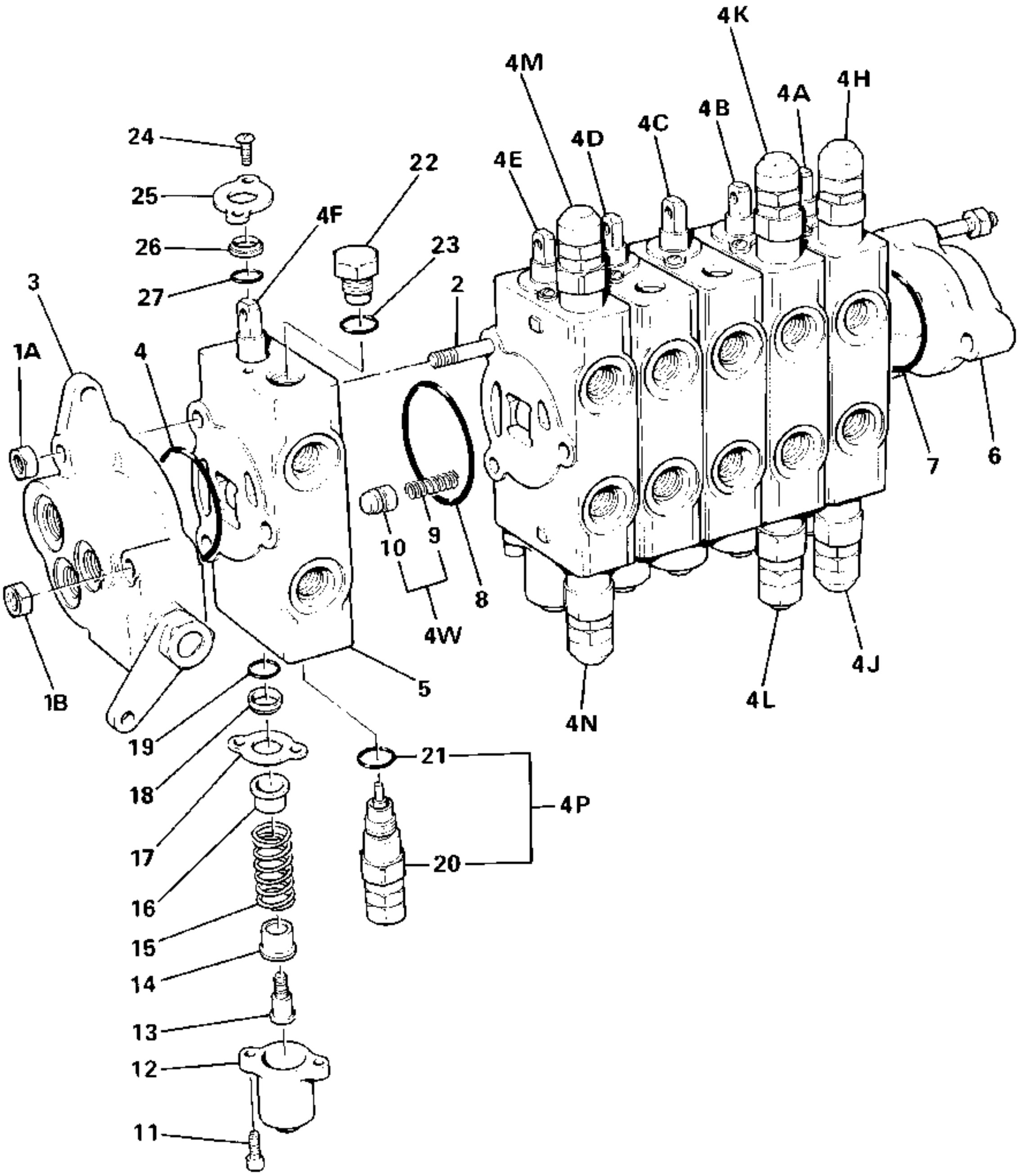
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S175610

Dismantling and Assembly

The numerical sequence shown on the illustration is intended as a guide to dismantling.

For assembly the sequence should be reversed.

Great care should be taken when dismantling and assembling a valve to avoid the following:-

Contamination
Damage to spools
Damage to seal grooves

Any of the above may result in possible problems with the operation of the valve.

Dismantling

When removing 'O' Rings and seals, use an appropriatly rounded tool that WILL NOT cause any damage to the seal grooves.

Discard ALL 'O' Rings. DO NOT use worn or damaged items.

Check Valves

Each of the identical load hold check valves **4R** to **4W** can be removed as shown at **4W**. Note only **4W** shown on illustration.

Ensure good condition of seating face on poppet **10** and on the mating face in the valve block.

Note: Valve block adapters, types **A**, **B**, **C** and **D** are torqued to 81 Nm (60 lbf ft; 8.3 kgf m).

Spools

Spools **4B**, **4C**, **4D**, **4E** and **4F** are identical but must not be interchanged as they are matched to their bores. Slew spool **4A** is different in design from the above spools.

All spools have the same centring and sealing components items **11** to **19** and **24** to **27**.

To completely dismantle a spool, follow the sequence **11** to **19** and **24** to **27**. To prevent spool rotation when turning screw **13**, hold a rod through the eye end of the spool.

Inspection

Inspect the valve components for scratches, nicks or any other type of damage, replace with new if required.

Assembly

Renew all 'O' rings.

Lubricate new seals with JCB Hydraulic Fluid and take care to prevent them from being damaged by the sharp edges of the spool.

Apply JCB Threadlocker and Sealer to threads of screw **13**.

Torque Settings

Item	Nm	kgf m	lbf ft
1A	17.6 - 20.4	1.76- 2.04	13 - 15
1B	41 - 49	4.2 - 5	30 - 36
11	6.1 - 7.5	0.62 - 0.76	4.5 - 5.5
13	9.5 - 10.9	0.97 - 1.11	7 - 8
22	41 - 68	4.15 - 6.9	30 - 50

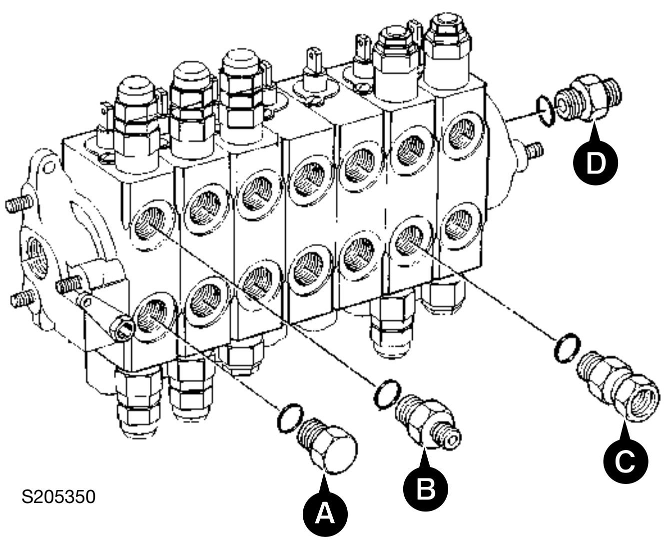
Relief Valves

Ensure that A.R.V's **4H** to **4P** are correctly adjusted and fitted in their specified positions.

Torque tighten A.R.V's **4H**, **4J**, **4K** and **4N** to 41 - 68 Nm (30 - 50 lbf ft, 4.15 - 6.9 kgf m).

Torque tighten A.R.V's **4L**, **4M** and **4P** to 41 - 68 Nm (30 - 50 lbf ft, 4.15 - 6.9 kgf m).

For relief valve dismantling and assembly procedure, refer to **Excavator Valve, Dismantling and Assembly - ARV's**.



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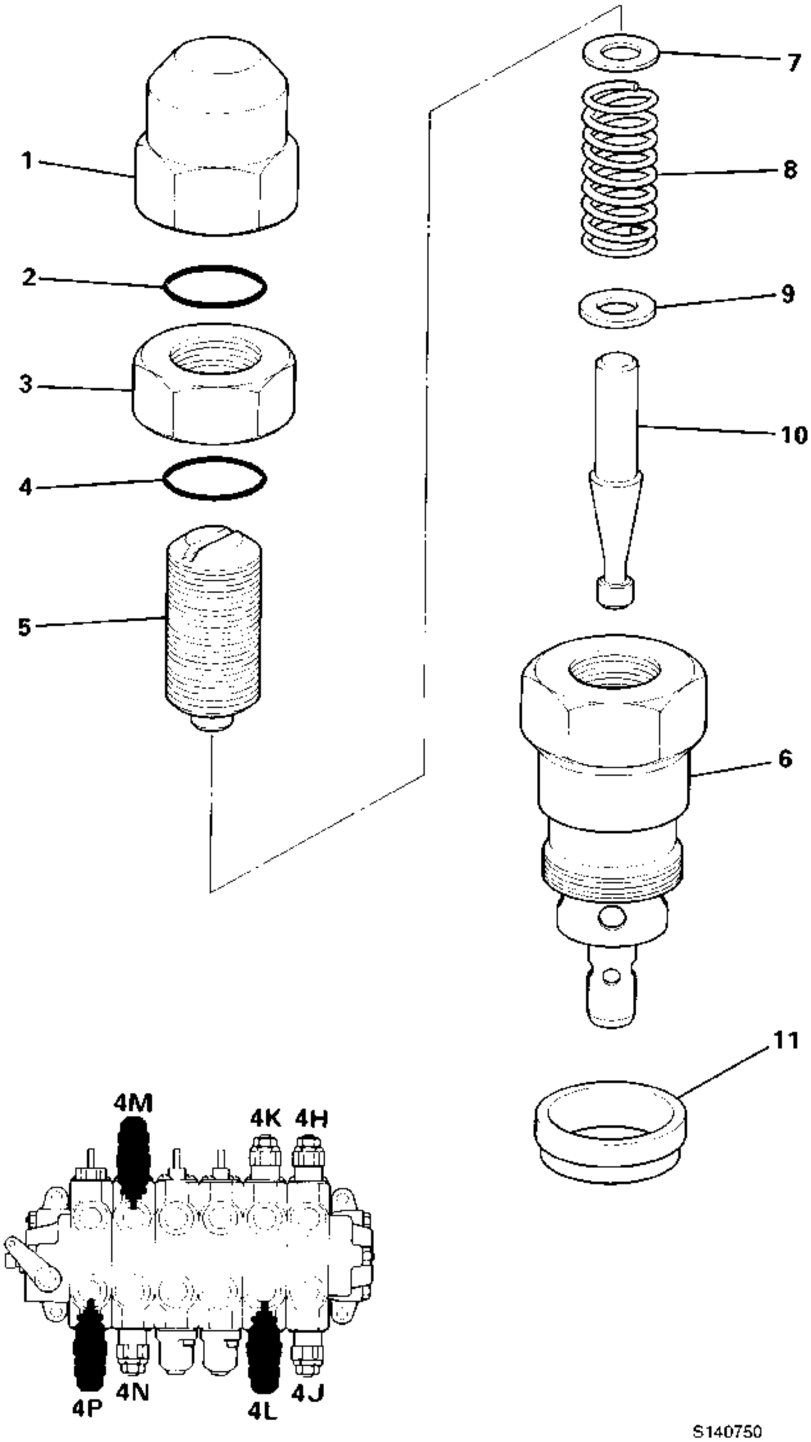
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4M
4K
4H
4P
4N
4L
4J
S140750

Dismantling and Assembly

Auxiliary Relief Valve (ARV)

Seven A.R.V's are fitted to the excavator valve block. The following procedure covers the dismantling and assembly of A.R.V's **4L, 4M** and **4P.** A.R.V's **4H, 4J, 4K** and **4N** are identical in design to those fitted in the loader valve, refer to **Loader Valve - Dismantling and Assembly**. The A.R.V's have various pressure settings, refer to **Technical Data**.

The numerical sequence shown on the illustration is intended as a guide to dismantling.

For assembly the sequence should be reversed.

Great care should be taken when dismantling and assembling a valve to avoid the following:-

Contamination
Damage to spools
Damage to seal grooves

Any of the above may result in possible problems with the operation of the valve.

Dismantling

When removing 'O' Rings and seals, use an appropriatly rounded tool that WILL NOT cause any damage to the seal grooves.

Discard ALL 'O' Rings. DO NOT use worn or damaged items.

Retain shims **7** for re-assembly.

Note: The arrangement of A.R.V.'s shown opposite is that used with the JCB 'X' control pattern.

For ISO '+' control pattern **4K** and **4M** swap positions, **4L** and **4N** swap positions.

Inspection

Inspect the valve components for scratches, nicks or any other type of damage, replace with new if required.

Assembly

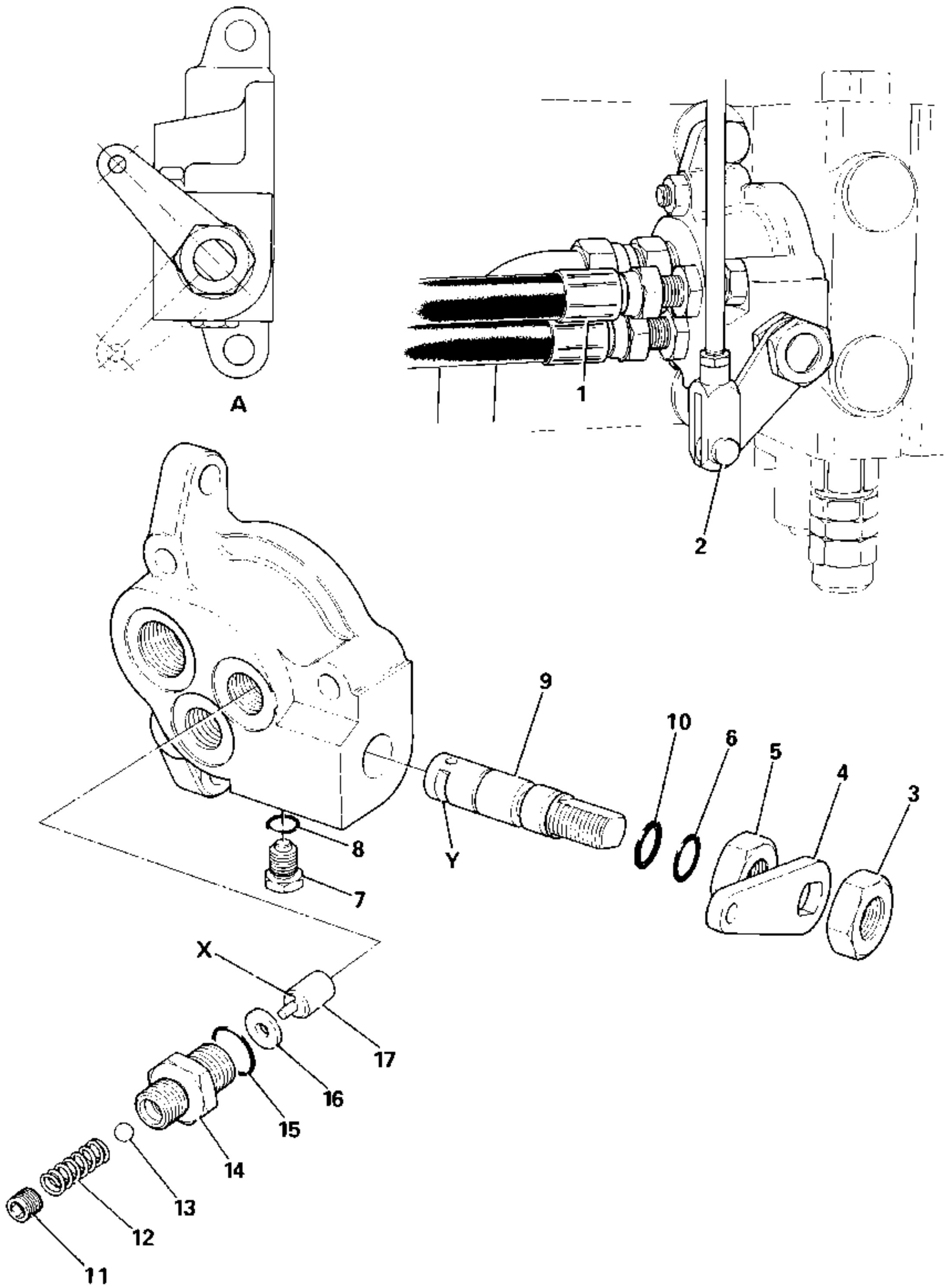
Renew all seals, using JCB Hydraulic Fluid as a lubricant.

Fit shims **7** to the same total thickness as those removed.

Note: The shims are only intended to limit the maximum pressure setting to which it is possible to adjust the valve. The specified pressure setting of each valve is achieved by adjusting screw **5** (see **Service Procedures, Pressure Testing - ARV's**). If the specified pressure cannot be achieved under test, it is permissible to add further shims as required.

Torque Settings

Item	Nm	kgf m	lbf ft
1	21.3 - 26.7	2.22 - 2.78	16 - 20
3	21.3 - 26.7	2.22 - 2.78	16 - 20
6	41 - 68	4.15 - 6.9	30 - 50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S175600

Dismantling and Assembly

Hydraclamp Valve

The numerical sequence shown on the illustration is intended as a guide to dismantling.

For assembly the sequence should be reversed.

Great care should be taken when dismantling and assembling a valve to avoid the following:-

Contamination
Damage to spools
Damage to seal grooves

Any of the above may result in possible problems with the operation of the valve.

Dismantling

When removing 'O' Rings and seals, use an appropriatly rounded tool that WILL NOT cause any damage to the seal grooves.

Discard ALL 'O' Rings. DO NOT use worn or damaged items.

Plug hose **1** to prevent loss of oil and entry of dirt.

Inspection

Visually inspect the valve components for scratches, nicks or any other type of damage, replace with new if required.

Assembly

Note: View '**A**' shows the clamp in the **OFF** position.

Ensure that orifice **X** is clear.

Lubricate new seals with JCB Hydraulic Fluid.

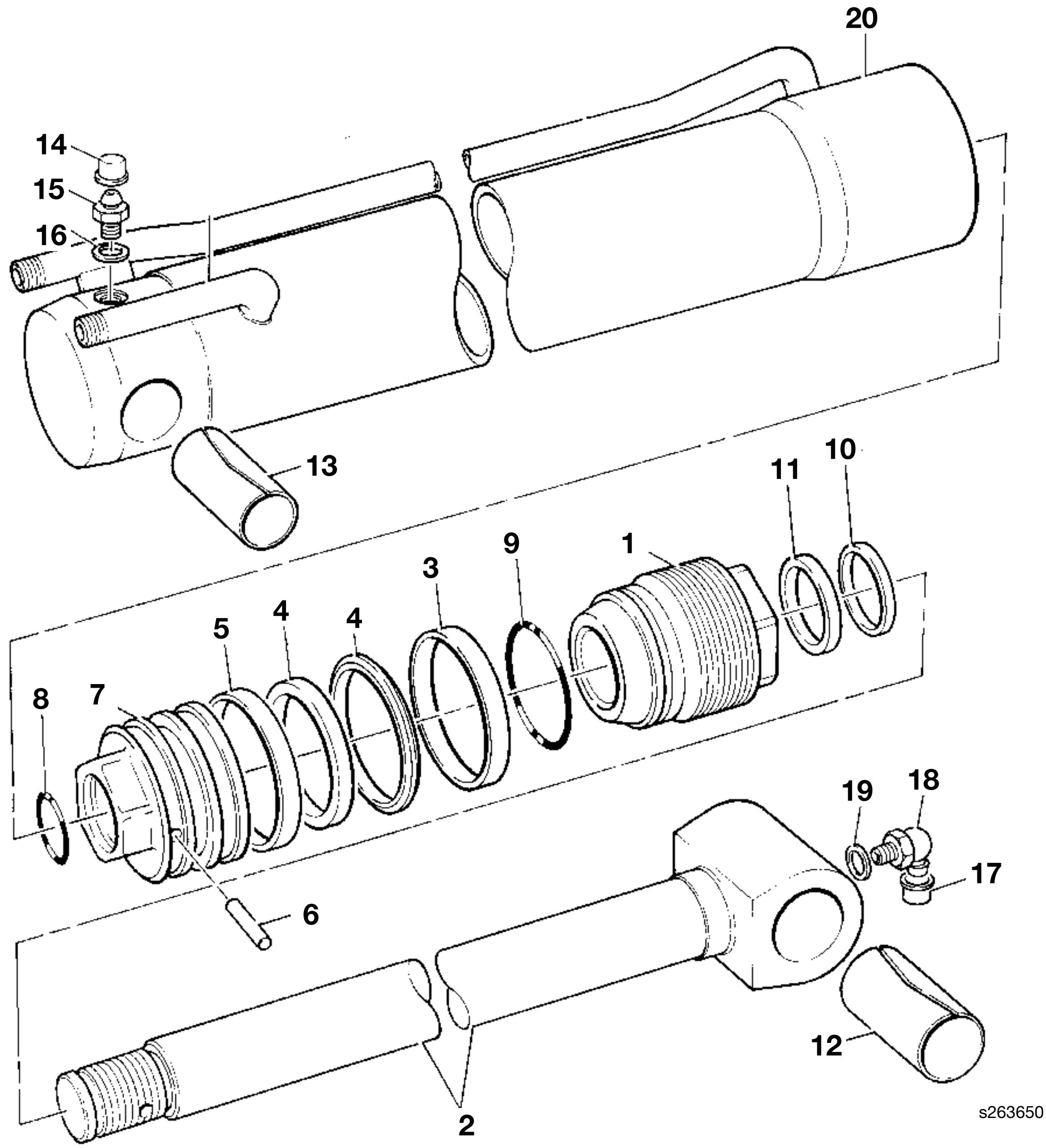
Ensure that plug **7** locates in groove **Y** of rotary spool **9**.

Torque nut **5** finger-tight before locking lever **4**.

Ensure that spool **9** rotates freely after tightening nuts **5** and **3**.

Torque Settings

Item	**Nm**	**kgf m**	**lbf ft**
3	55 - 67	5.6 - 6.84	40.5 - 49.5
7	3.3 - 4.7	0.35 - 0.49	2.5 - 3.5
14	21.3 - 26.7	2.22 - 2.78	16 - 20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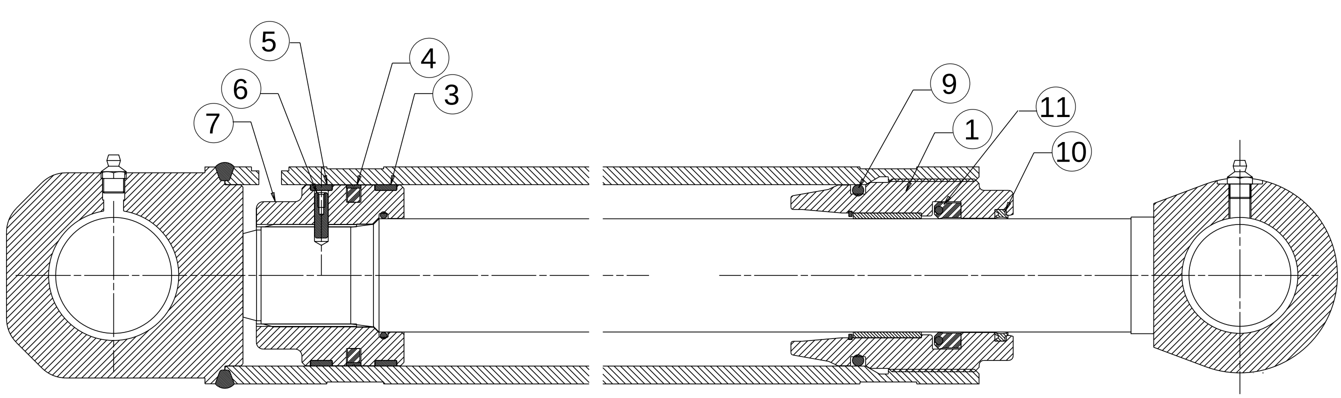
5
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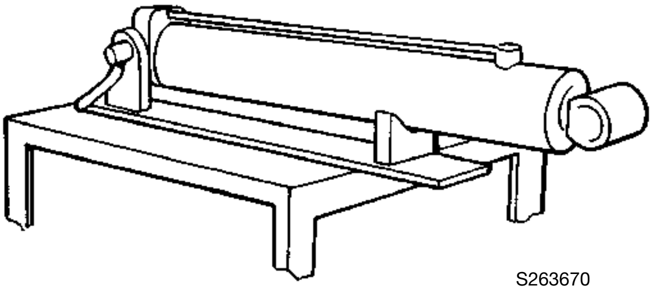
A263680

Dismantling and Assembly - Typical Ram

When Dismantling
The numerical sequence shown on the illustration is intended as a guide to dismantling.

For assembly the sequence should be reversed.

Place ram assembly on a locally manufactured strip/rebuild bench as shown.



S263670

Slacken end cap **1** using special spanner (see **Service Tools**) and remove the piston rod assembly **2** from the cylinder.

⚠ WARNING

If air or hydraulic pressure is used to force out the piston assembly, ensure that the end cap is securely fitted. Severe injury can be caused by a suddenly released piston rod.
HYD 1-2

Position piston rod assembly on bench in place of ram cylinder. Remove seal **4** and wear rings **3** and **5** from piston head.

Extract dowel **6** from the piston head using a metric screw (M3, M4, or M6 depending on ram size) threaded into the extractor hole.

Remove piston head from rod using special spanner (see **Service Tools**).

Remove gland bearing and end cap **1** from piston rod and remove the 'O' ring **9**, wiper seal **10** and rod seal **11**. Check the end cap bearing for damage, scores or nicks. If damaged, the bearing must be replaced as part of the end cap assembly.

Ensure that metal components are free from scoring, nicks and burrs. A damaged rod will impair the life of the seals.

Check the bore of the ram cylinder for damage.

When Assembling

Clean threads of piston rod, piston head, end cap and cylinder using a wire brush. Use JCB Cleaner & Degreaser to ensure that all threads are free from grease, hydraulic oil and old sealant. Allow 15 minutes for solvent to dry before applying sealant.

Ensure that lubricants used during assembly do not come into contact with sealant.

Refer to the JCB Ram Sealing Procedure for the correct method of fitting seals to the end cap and piston head.

Apply JCB Activator to threads of end cap and cylinder. Allow Activator to dry for 15 minutes before bringing into contact with sealant (JCB Threadlocker).

Note: Neither Threadlocker nor Activator must be allowed to contact seals, bearing rings, or 'O' rings.

Fit locking dowel **6** to piston head/rod as follows:

1 Fit 'O' ring **8** into piston head **7**.

2 Fit piston head to piston rod and torque tighten to 405 Nm (300 lbf ft).

3 New ram Shaft and piston head fitted.
- If both are required, the following procedure should be followed:

  i Drill through piston head into piston rod. Use an undersized diameter drill first as a guide and then drill with the correct size diameter drill to suit; refer to the table for drill diameters and depths.

  ii Remove all swarf and contamination. Insert dowel **6** into drilled hole, make sure tapped extractor hole is to outside.

4 New piston head fitted on a **pre-drilled piston rod.**
- Re-drill and dowel **BOTH** the piston head and piston rod at 90° from the existing drilled dowel hole in the piston rod. Follow the procedures described in step 3.

5 New piston rod fitted to a **pre-drilled piston head.**
- Use the pre-drilled hole in the piston head. Care must be taken not to elongate the existing hole in the piston head.

  i Use a drill the same diameter as the pre-drilled hole in the piston head to make a 'centre mark' in the piston rod. DO NOT drill the piston rod at this stage.

...........continued

Dismantling and Assembly:
- Typical Ram

When Assembling (continued)

ii Use an undersized diameter drill as a guide and drill into the piston rod to the required depth (see table), make sure the drill has centred correctly on the 'centre mark' made at step 5i.

iii Use the correct size diameter drill to suit the dowel and drill to the required depth (see table).

iv Remove all swarf and contamination, insert the dowel.

Position cylinder on bench and install rod assembly into cylinder.

Apply JCB Threadlocker to first three threads of cylinder, torque tighten the end cap to 678 Nm (500 lbf ft).

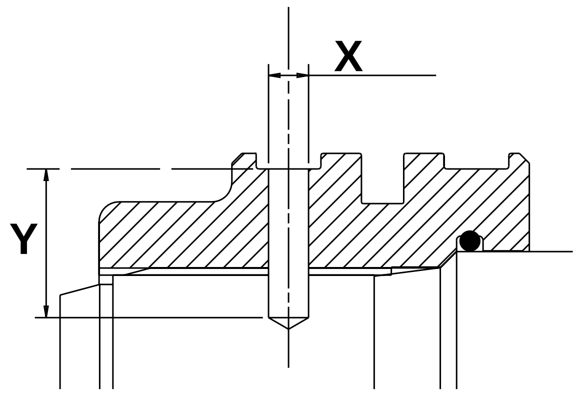
Note: If hydraulic oil contacts uncured Threadlocker a weakening of the bond will result. Allow at least 2 hours cure time at an ambient temperature of 20 °C before filling the ram with oil.

Note: Cold weather operation. When operating in conditions which are consistently below freezing, it is recommended that the rams are operated slowly to their full extent before commencing normal working.

Torque Settings

Item	Nm	kgf m	lbf ft
7	405	41.3	300
1	678	69.2	500

DRILLING DETAILS FOR PISTON HEAD RETENTION



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(all dimensions in mm)

Ram Size	Dowel Size	Guide Drill Ø	Guide Drill Depth	Dowel Drill Ø X	Dowel Drill Depth Y
80 x 50 70 x 40	6Ø x 20	4	21	6.02/6.10	22/23
90 x 50 100 x 60	8Ø x 25	5	24	8.02/8.10	27/28
110 x 60 110 x 65	12Ø x 30	8	28	12.02/12.10	32/33
120 x 65 130 x 75	12Ø x 35	8	33	12.02/12.10	37/38

JCB Ram Sealing Procedure

To fit new rod seal:

Use seal fitting tool (892/00334) to fit rod seals, the size (diameter) and position of pins **A** is determined by the diameter and radial width of the rod seal being fitted.

The pins are screwed into threaded holes in the tool body, the spacing of the holes is designed to suit small or large diameter rod seals.

1 Open the tool as shown at **B** and insert the new rod seal, the seal must be fitted behind the two front pins but in front of the rear pin as shown.

Note: Later ram end caps and piston heads have metric threads. The seals are also different, make sure the correct seals are fitted. On metric threaded rams make sure the seals are fitted the correct way round, as shown at **P** and **Q**.

2 Close the tool as shown at **C**. The seal must form a reniform (kidney shape).

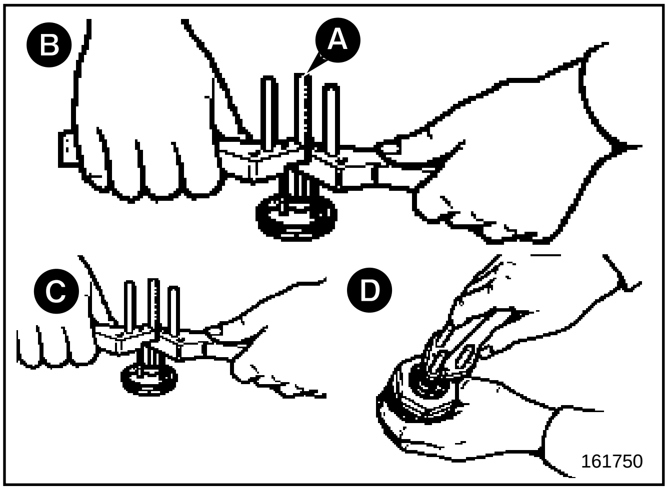
3 Before fitting the rod seals check the seal grooves are free of contamination and sharp edges,

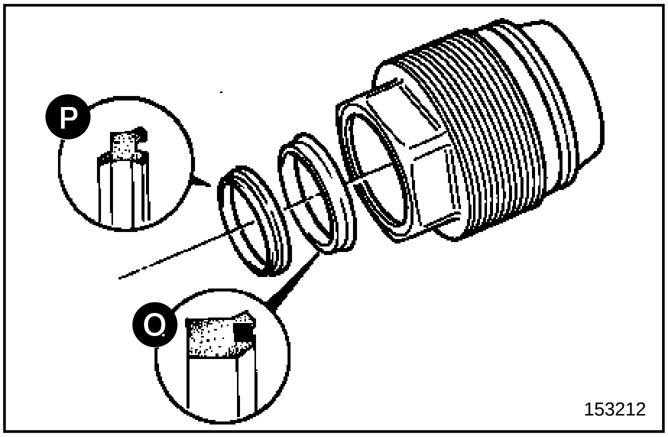
4 Locate the seal in the end cap groove, shown at **D,** when the seal is in position, open the tool to release the seal. Make sure the seal is correctly installed in its groove and remove the tool.

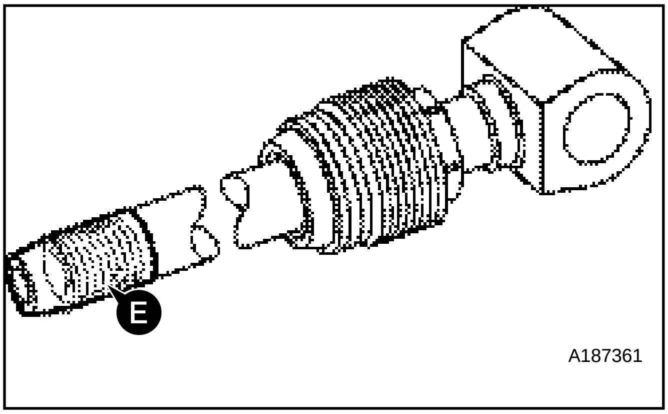
5 Fit rod wiper seal **P** into seal groove. Make sure the seal is correctly installed as shown.

Note: Some rod wipers, ie power track rod, may use a metal encased seal which is pressed into the housing. Care must be taken to ensure the seal is square before it is pressed in.

Sleeve **E** must be used to protect the rod seals from damage when fitting end cap onto the piston rod. There are various sizes of sleeve, see Service Tools, Section 1. Make sure the hexagon on the end cap is towards the eye end of the rod.



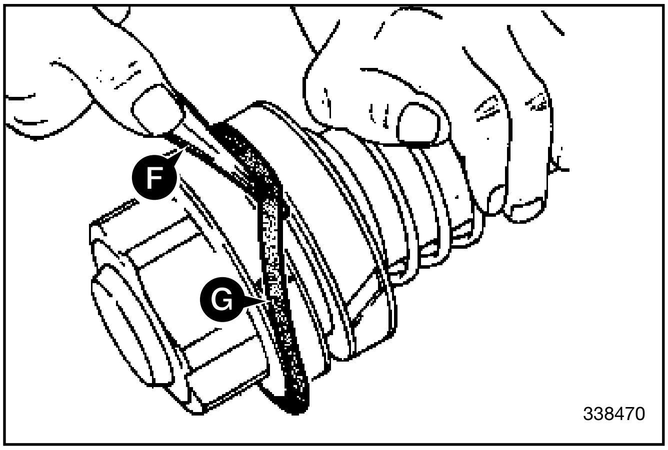




JCB Ram Sealing Procedure (continued)

Fit new piston head seals:

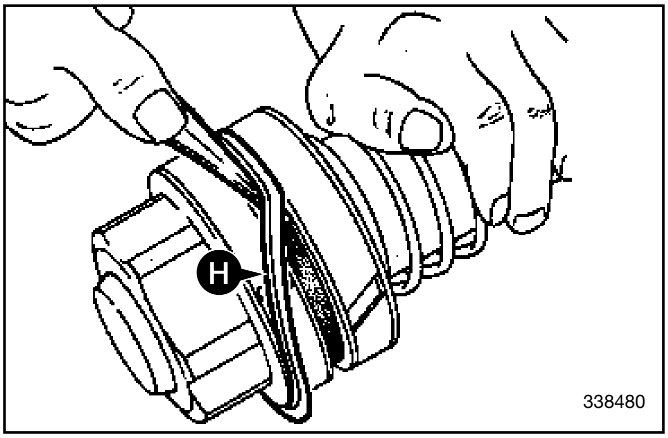
6 Use a blunt instrument (892/01027) shown at **F**, lever the inner seal **G** into the piston head seal groove, do not let the seal twist. There are identification marks on the outer diameter of the seal, make sure the marks are visible and the seal is free to rotate, if not remove the seal and refit



338470

7 Fit outer seal **H** using the same procedure as step 6. Check the external grooves are visible.

8 Ensure O ring is fitted into the internal seal groove on the piston head. Screw the piston head onto the thread of the piston rod, refer to the relevant section for torque figure and completion of ram assembly.



338480

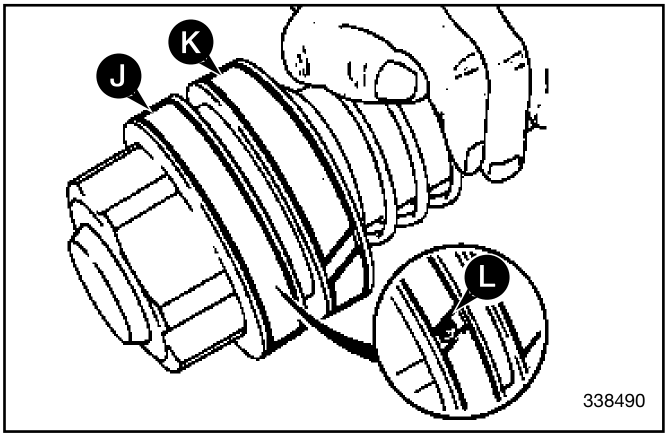
9 Fit the piston head retaining dowel, see ram dismantling and assembling relevant section

10 Fit wear rings **J** and **K**. Rotate the wear rings so that the piston retention dowel is covered by the wear ring, NOT as shown at **L**.

Fit the piston rod and head assembly into the cylinder:

11 Insert the piston/rod assembly into the cylinder. Align the rod and head assembly until parallel with the cylinder then push the assembly into the cylinder.

12 Fit the end cap, refer to the relevant section for torque figure and completion of ram assembly.



338490

Accumulator Removal and Replacement

Removal

1 Park the machine on level ground, lower the loader arms, switch off the engine and chock all four wheels. Release all hydraulic pressure in the accumulator by selecting the SRS ON and operating the loader arm hydraulic lever.

⚠ DANGER

Before disconnecting or dismantling the accumulator discharge all gas pressure. Failure to comply can cause rapid discharge of gas and/or hydraulic fluid which can result in death, personal injury and damage to the machine.
Hyd 2-5

2 Discharge the accumulator, refer to **Service Procedures, Smooth Ride System - Charging/Discharging the Accumulator**.

3 Disconnect the hydraulic hose **A** and plug.

4 Loosen both 'U' clamps **B** and slide the accumulator towards the rear of the machine. When clear of the 'U' clamps carefully lower and withdraw accumulator.

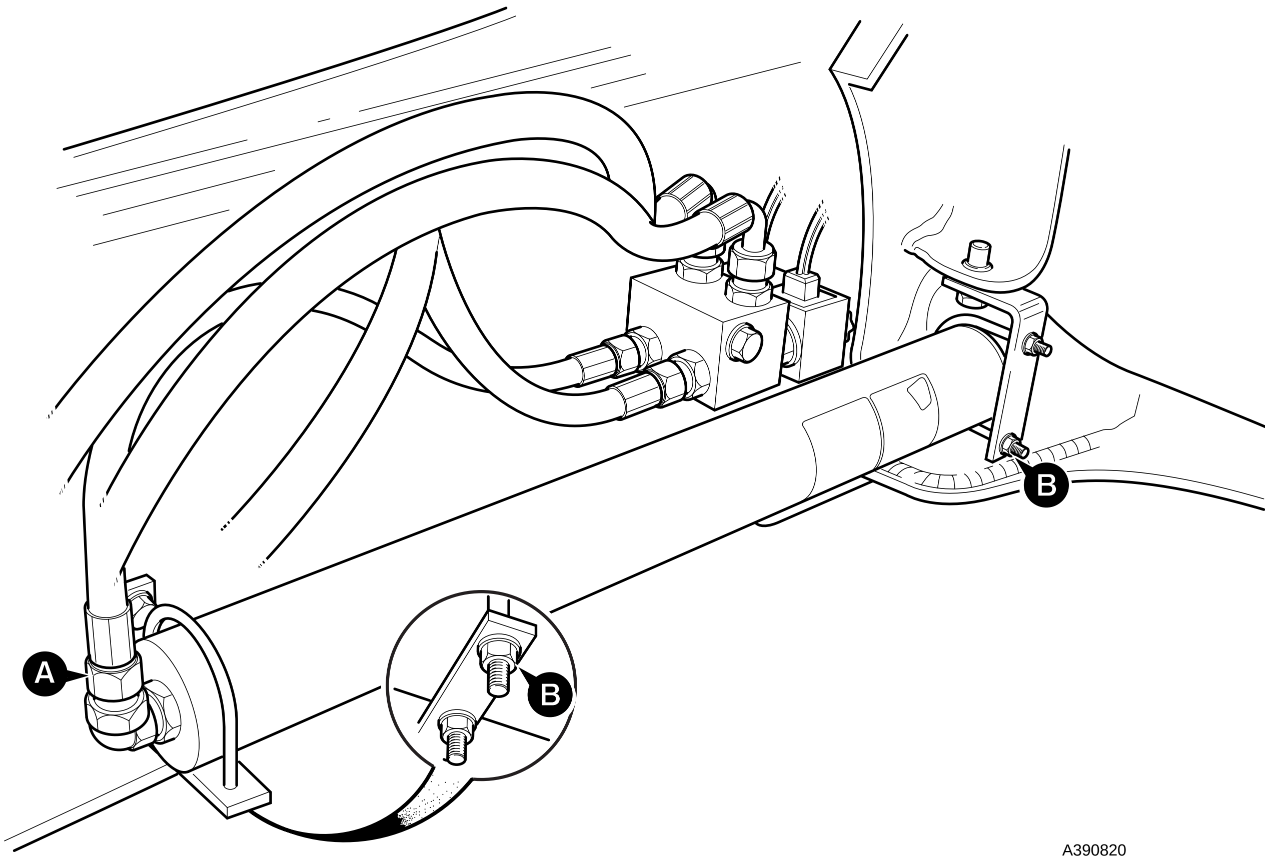
Replacement

Replacement is a reverse of removal.

1 Charge the accumulator, refer to **Service Procedures, Smooth Ride System - Charging/Discharging the Accumulator**.

2 Operate the machines hydraulic system. Check for correct operation and hydraulic leaks.

3 Replenish the hydraulic system with the recommended hydraulic fluid as required, refer to Section 3 **Lubricants and Capacities**



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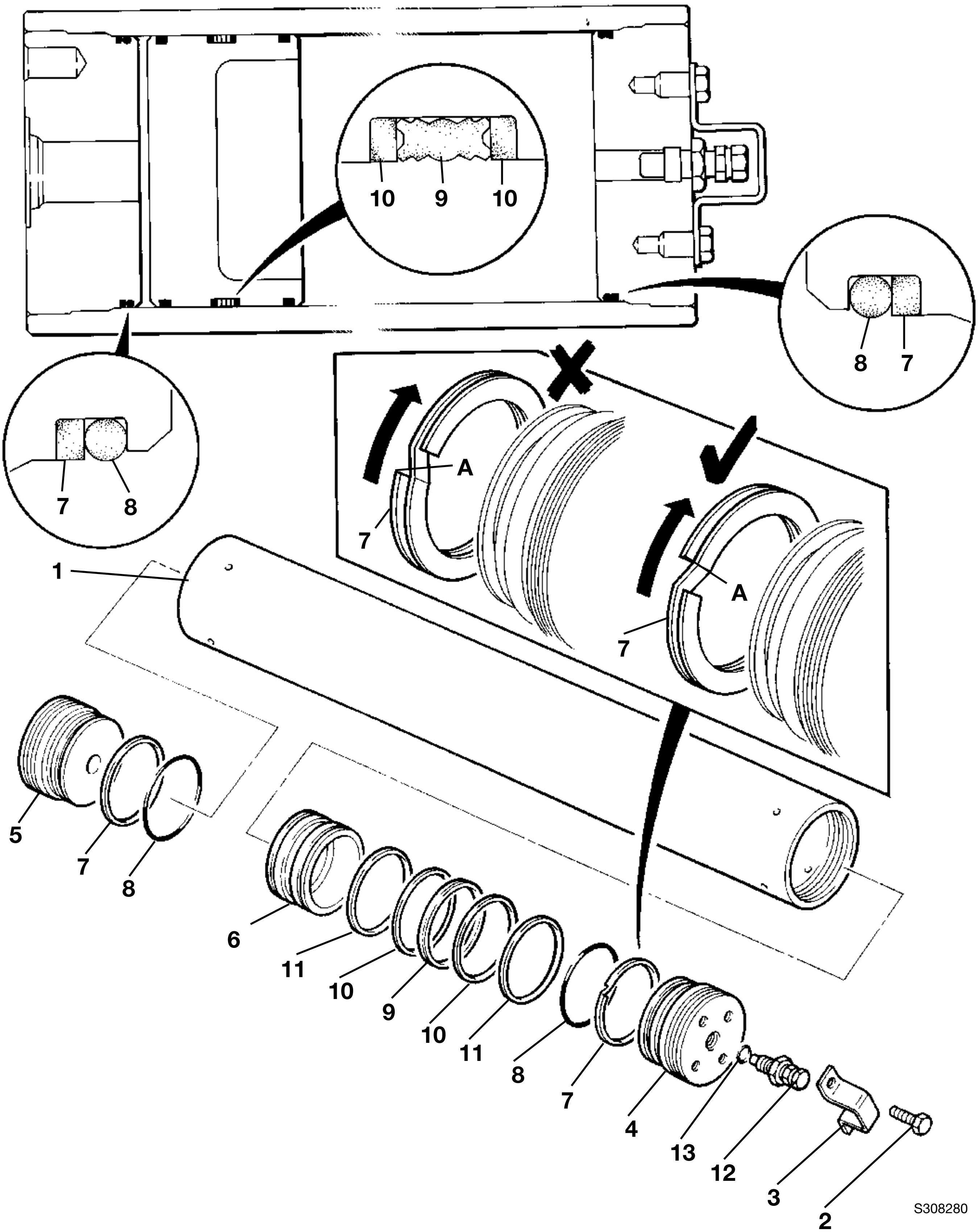
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S308280

Accumulator Dismantling and Assembly

Dismantling

DANGER

Before disconnecting or dismantling the accumulator discharge all gas pressure. Failure to comply can cause rapid discharge of gas and/or hydraulic fluid which can result in death, personal injury and damage to the machine.
HYD 2-5

1 Check that the accumulator has been fully discharged, refer to **Service Procedures, Smooth Ride System - Charging/Discharging the Accumulator**.

2 Secure the accumulator in horizontal position.

CAUTION

The gas end cap (cap with gas valve) must be removed before the hydraulic end cap. This allows any residual pressure to escape through the safety vent holes. If the hydraulic end cap is removed first the piston will cover the safety vent holes, which could result in the piston being forced out under pressure which may result in personal injury.
HYD 2-6

4 Fit three pins into the holes in gas end cap **4**, using a long bar working against the pins unscrew the end cap.

5 Fit three pins into the holes in hydraulic end cap **5**, using a long bar working against the pins unscrew the end cap.

6 Remove and discard ‘O’ rings and back up rings from end caps.

7 Remove the piston **6** by pushing from the hydraulic end with a bar.

CAUTION

Do not remove the piston by applying compressed air at the opposite end.
HYD 2-7

8 Remove piston seal and ‘O’ rings.

Inspection

Inspect piston for cracks, burrs around the ‘O’ ring grooves, or damage. Examine the body bore **1**, using a light, for scratches or scoring. Inspect end caps for damaged threads or burrs on ‘O’ ring grooves.

Minor nicks, scratches or light scoring of the body bore may be removed by using a very fine paper. Dress the bore until all apparent imperfections have been removed.

All seals and ‘O’ rings must discarded and new ones fitted.

Assembly

1 Coat all internal components with clean hydraulic oil.

2 Fit piston seal **9**, teflon back up rings **10** and seals **11**.

3 Fit piston assembly into bore **1** with hollow side towards the gas end. Do not let piston seal drag on threads, the piston must go into the bore exactly square and very slowly. The piston is a tight fit, use a hammer and a block of wood to tap the piston until all of the piston is 2in. (50mm) below the beginning of honed bore.

Note: Keep pressure on the piston while tapping through the bore chamfer, otherwise the piston will bounce back, damaging the piston ring.

4 Fit end cap back up seal **7**. Make sure the seal is fitted with leading edge **A** pointing in a counter clockwise direction otherwise the seal will bind when the end cap is fitted.

5 Fit end cap ‘O’ rings **8**, it is important that seals **7** and **8** are fitted in the correct position in relation to each other to prevent leaks.

6 Fit end caps **4** and **5**, use pins and a long bar. Make sure the gas end cap is fitted to the correct end, piston hollow end to gas side.

Note: The end caps will stop against the chamfer leading into the honed bore, ‘O’ ring sealing is not dependent upon cap tightness.

7 Use new ‘O’ ring **13** and fit the gas valve **12**.

Contents Page No.

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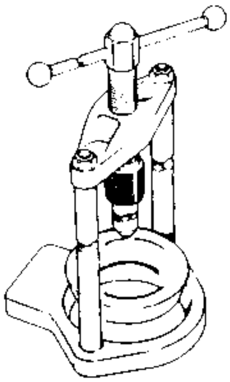
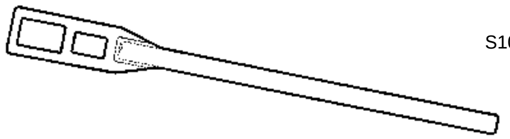
Axles

892/00179 Bearing Press
(use with appropriate adapters)



S188200

892/00812 Drive Coupling Spanner for front and rear axle yoke couplings and for 4WD output coupling on Syncro Shuttle

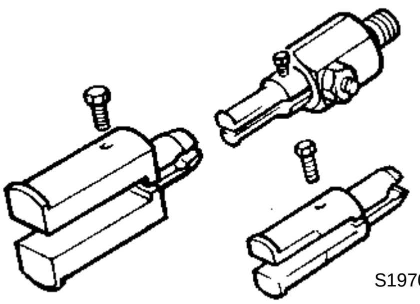


S107750

892/00225 Adapter - Impulse Extractor

Small	17mm to 25mm
Medium	25mm to 45mm
Large	45mm to 80mm

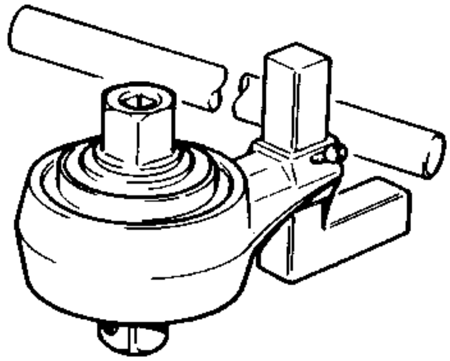
993/59500 Adapter - Impulse Extractor



S197080

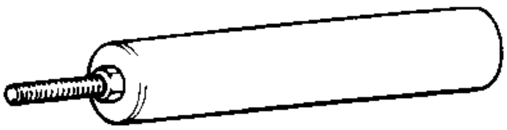
Axles (cont'd)

992/04000 Torque Multiplier (use in conjunction with a torque wrench to give a 5:1 multiplication when tightening pinion nuts)



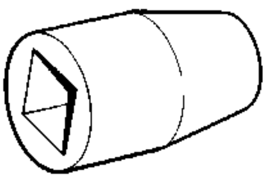
S197030

992/00800 Extractor for removing front axle pivot pin



S197050

892/00822 Splined Bolt Socket for driveshafts

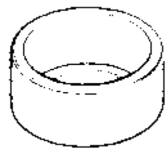


S197060

992/07609 Adapter - Steer/Drive Axle Pinion Bearing Cone

S188160

892/00174 Measuring Cup - Pinion Head Bearing

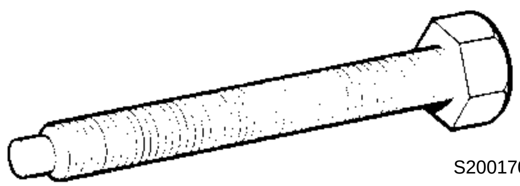


S190770

892/00224 Impulse Extractor Set for Hub Bearing Seals

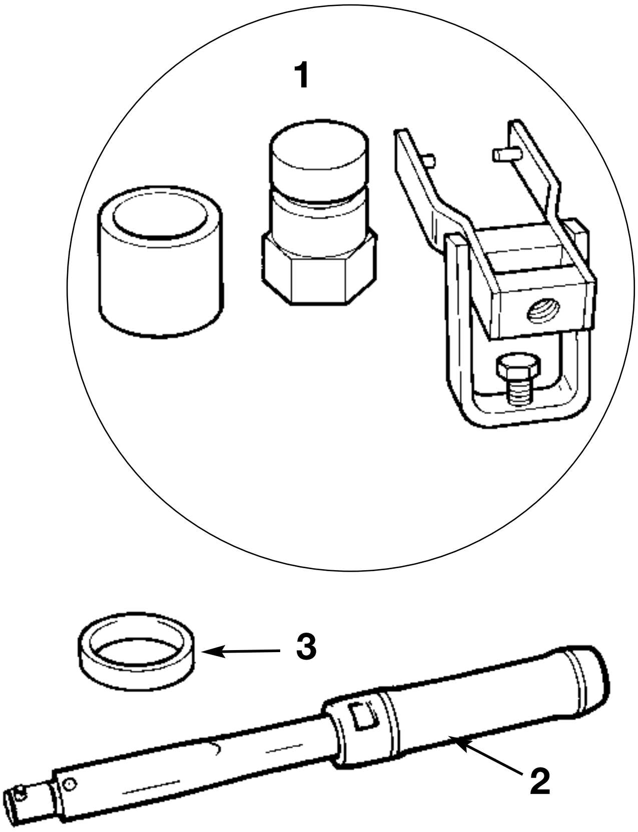
S197070

892/00833 Annulus Removal Tool



S200170

Axles (cont'd)

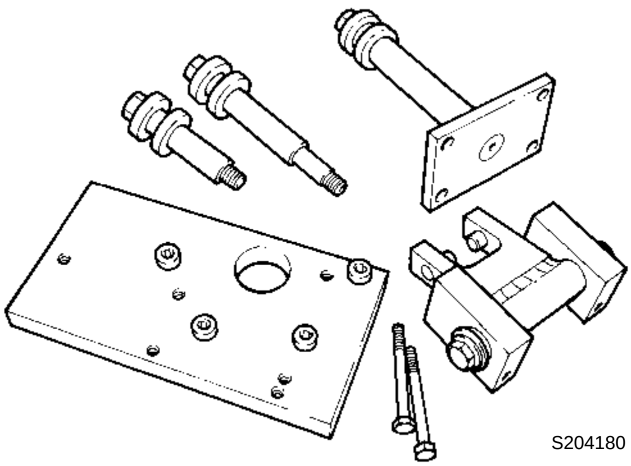


Solid Spacer Setting Kit

1	892/00918	Setting Tool Kit
2	993/70111	Breakback Torque Wrench
3	921/52600	Spacer Kit
	921/52627	Spacer 14.20 Service use
Comprises of:		
	921/52601	Spacer 12.75
	921/52602	Spacer 12.80
	921/52603	Spacer 12.85
	921/52604	Spacer 12.90
	921/52605	Spacer 12.95
	921/52606	Spacer 13.00
	921/52607	Spacer 13.05
	921/52608	Spacer 13.10
	921/52609	Spacer 13.15
	921/52610	Spacer 13.20
	921/52611	Spacer 13.25
	921/52612	Spacer 13.30
	921/52613	Spacer 13.35
	921/52614	Spacer 13.40
	921/52615	Spacer 13.45
	921/52616	Spacer 13.50
	921/52617	Spacer 13.55
	921/52618	Spacer 13.60
	921/52619	Spacer 13.65
	921/52620	Spacer 13.70
	921/52621	Spacer 13.75
	921/52622	Spacer 13.80
	921/52623	Spacer 13.85
	921/52624	Spacer 13.90
	921/52625	Spacer 13.95
	921/52626	Spacer 14.00

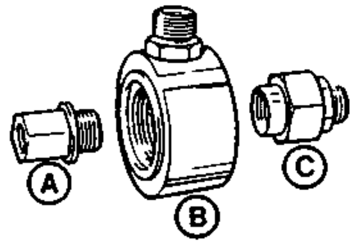
Syncro Shuttle Gearbox

993/59400 End Float Setting Tool for gearbox:
993/59401 Base Plate
993/59402 Setting Yoke
993/59403 Mainshaft Adapter (long)
993/59404 Mainshaft Adapter (short)
993/59405 Ouput Yoke Adapter Plate
993/59406 Setting Yoke Support Pillars



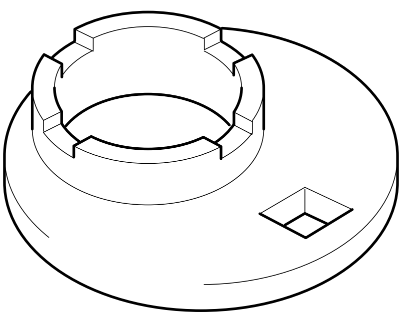
S204180

A 892/00304 Flow Test Adapter
B 892/00301 Flow Test Adapter
C 892/00302 Flow Test Adapter



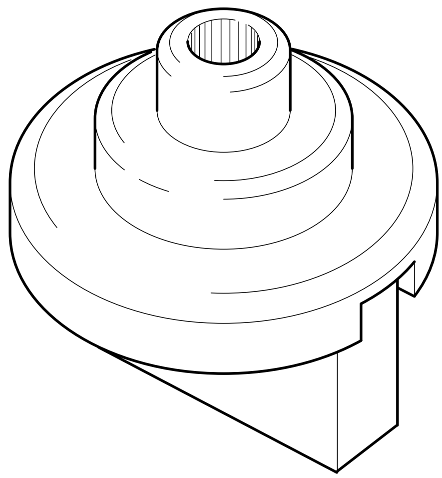
S188210

892/01064 Adaptor Spanner for reverser unit stake nut.



A388070

892/01065 Holding Fixture for reverser unit dismantling/assembly.



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Tyres

FRONT

Type	Size	Ply	Pressure (Normal Duty) † bar	lbf/in^2	Pressure (Heavy Duty) †† bar	lbf/in^2
Firestone	12.5 x 18	10	1.5	22	2.1	30
	12 x 18	12	*	*	*	*
	12.5 x 20	10	*	*	*	*
Continental	12.5 x 18	10	1.75	26	2.55	37
	14.5/80 x18	-	*	*	*	*
	14.5 x 20	10	*	*	*	*
Goodyear	12.5 x 18	10	*	*	*	*
	12.5/80 x 18	10	*	*	*	*
	340/80 R18	-	*	*	*	*
	12.5 x 20	10	*	*	*	*
Michelin	335 x R18	-	1.8	26	2.7	39
	335/65 R18	-	*	*	*	*
	405/70 R20	-	*	*	*	*
Dunlop	15.5/55 R18	-	*	*	*	*

REAR

Type	Size	Ply	Pressure (Normal Duty) † bar	lbf/in^2	Pressure (Heavy Duty) ††† bar	lbf/in^2
Firestone	12.5 x 18	10	1.7	25	1.9	28
	12 x 18	12	*	*	*	*
	12.5 x 20	10	*	*	*	*
Continental	12.5 x 18	10	1.75	26	2.0	29
	14.5/80 x18	-	*	*	*	*
	14.5 x 20	10	*	*	*	*
Goodyear	12.5 x 18	10	*	*	*	*
	12.5/80 x 18	10	*	*	*	*
	340/80 R18	-	*	*	*	*
	12.5 x 20	10	*	*	*	*
Michelin	335 x R18	-	1.8	26	2.2	32
	335/65 R18	-	*	*	*	*
	405/70 R20	-	*	*	*	*
Dunlop	15.5/55 R18	-	*	*	*	*

* TBA

† These tyre pressures are recommended for road travel and normal working conditions.

†† These tyre pressures are recommended when handling heavy or palletised loads.

††† These tyre pressures are recommended when using a rock breaker or patch planer.

Note: If the tyres fitted to your machine are not listed, then contact your JCB Distributor for advice, DO NOT guess tyre pressures.

Front Axle (SD55)

Type	JCB spiral bevel input with epicyclic hub reduction
Designation	SD55 (without brakes)
Installation	Centre pivot
Weight (dry, with no steer rams and without wheels)	354 kg (780 lb) approx
Overall Gear Ratio (20'' wheels)	18.6:1
Overall Gear Ratio (18'' wheels)	16.2:1
Crownwheel & Pinion Ratio	3:1
Number of Teeth	
Crownwheel	33
Pinion	11
Hub reduction	5.4:1
Toe-in	0°
Castor angle	0°
Camber angle	1°
Kingpin inclination	0°
Number of steer rams	1

Rear Axle (SD55)

Type	JCB spiral bevel input with epicyclic hub reduction
Designation	SD55 (with brakes)
Type of Brakes	Oil immersed multi-plate disc located centre section
Installation	Rigid pad mount
Weight (dry, with no steer rams and without wheels)	425 kg (937 lb) approx
Overall Gear Ratio (20'' wheels)	18.6:1
Overall Gear Ratio (18'' wheels)	16.2:1
Crownwheel & Pinion Ratio	3:1
Number of Teeth	
Crownwheel	33
Pinion	11
Hub reduction	5.4:1
Toe-in	0°
Castor angle	0°
Camber angle	1°
Kingpin inclination	0°
Number of steer rams	1

Syncro Shuttle

Syncro Shuttle		Combined torque converter, reverser, and gearbox unit with brake disc/caliper type parking brake on output shaft to front wheels.	
Type		SS400	
Drive Output		Permanent 4 wheel-drive, double yoke	
Weight (dry)		150 kg (330 lb)	
Gear Ratios		30 kph (18 mph)	20 kph (12 mph)
	1st	4.27:1	6.31:1
	2nd	2.50:1	3.70:1
	3rd	1.18:1	1.75:1
	4th	0.70:1	1.03:1

Syncro Shuttle (cont'd)

Converter Pressures (in neutral)		bar	kgf/cm^2	lbf/in^2
Converter In at 50 deg.C	1000 rev/min	2.4 - 3.4	2.5 - 3.5	35 - 50
	2000 rev/min	5.2 - 6.5	5.3 - 6.7	75 - 95
Converter In at 100 deg.C	1000 rev/min	1.3 - 2.0	1.4 - 2.1	20 - 30
	2000 rev/min	5.2 - 5.9	5.3 - 6.0	75 - 85
Converter Out (measure at 50 deg.C and 2000 rev/min)		3.4	3.5	50 max
Converter Relief (Safety) Valve Pressure		6.5	6.7	95 max
Lubrication Pressures (in neutral)				
At 50 deg.C	1000 rev/min	0.2 - 0.3	0.2 - 0.4	3.0 - 5.0
	2000 rev/min	0.4 - 0.7	0.4 - 0.7	6.0 - 10.0
At 100 deg.C	1000 rev/min	0.1 - 0.2	0.1 - 0.2	2.0 - 3.0
	2000 rev/min	0.3 - 0.6	0.3 - 0.6	4.0 - 8.0
Main Line Pressure (in neutral)				
At 50 deg. C	1000 rev/min	9.3 - 10.3	9.5 - 10.5	135 - 150
	2000 rev/min	10.7 - 11.7	10.9 - 12.0	155 - 170
At 100 deg.C	1000 rev/min	9.3 - 10.3	9.5 - 10.5	135 - 150
	2000 rev/min	9.3 - 10.3	9.5 - 10.5	135 - 150
Clutch Pressure (forward and reverse) †				
At 50 deg. C	1000 rev/min	7.6 - 9.7	7.7 - 9.8	110 - 140
	2000 rev/min	9 - 11	9.1 - 11.25	130 - 160
At 100 deg.C	1000 rev/min	7.6 - 9.7	7.7 - 9.8	110 - 140
	2000 rev/min	7.6 - 9.7	7.7 - 9.8	110 - 140

† Note: The forward and reverse clutch pressures should always be the same as the mainline pressure less (a maximum of) 1.7bar (25lbf/in^2; 1.8kgf/cm^2). If the mainline pressure is in the lower part of the tolerance band, then the forward and reverse clutch pressures should also be in the lower part of the tolerance band and vice versa.

Flow Rates (in neutral)		litres/min	UK gal/min	US gal/min
Cooler at 50 deg.C	1000 rev/min	10.4 - 13.6	2.3 - 3.0	2.8 - 3.6
	2000 rev/min	14.5 - 20.0	3.2 - 4.4	3.8 - 5.3
Cooler at 100 deg.C	1000 rev/min	10.2 - 12.5	2.3 - 2.8	2.7 - 3.3
	2000 rev/min	22.7 - 26.1	5.0 - 5.7	6.0 - 6.9
Pump at 50 deg.C	1000 rev/min	11.0 - 15.0	2.5 - 3.3	2.9 - 4.0
	2000 rev/min	22.5 - 29.5	5.0 - 6.5	6.0 - 7.8

Syncro Shuttle (cont'd)

Torque Converters

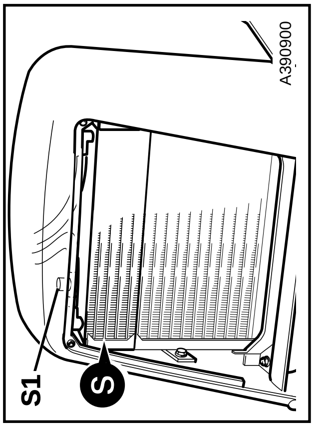
Ratio	2.8:1	2.78:1	2.4:1
Colour Coded Dots	3 Brown	1 Pink & 1 Yellow	2 Orange & 1 Green
Designation	SSL11	SSS11	WH11

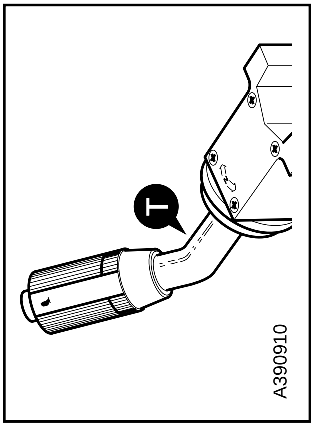
Stall Figures

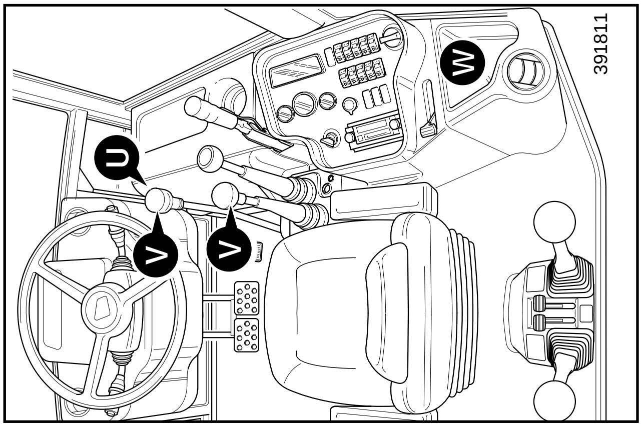
		2CX 210S	Airmaster	Farm Master	2CX - 20 kph	2CXU 210SU
Engine Stall Speed						
1 Converter only						
	max r.p.m.	2127	2127	1790	2170	2127
	min. r.p.m.	2027	2027	1700	2070	2027
2 Converter + MRV						
	max. r.p.m.	1825	1825	1490	1848	1825
	min. r.p.m.	1725	1725	1400	1748	1725
Build Specification						
Engine Size	65 bhp	•	•		•	•
	74 bhp			•		
Converter Type	SSL11 (2.8:1)	•	•			•
	SSS11 (2.78:1)				•	
	WH11 (2.4:1)			•		
Pump Size	58 l/min (12.7 gal/min) (15.3 USA gal/min)	•	•	•	•	•
Fan Ratio	1 to 1	•	•		•	
	1 to 1.25			•		•

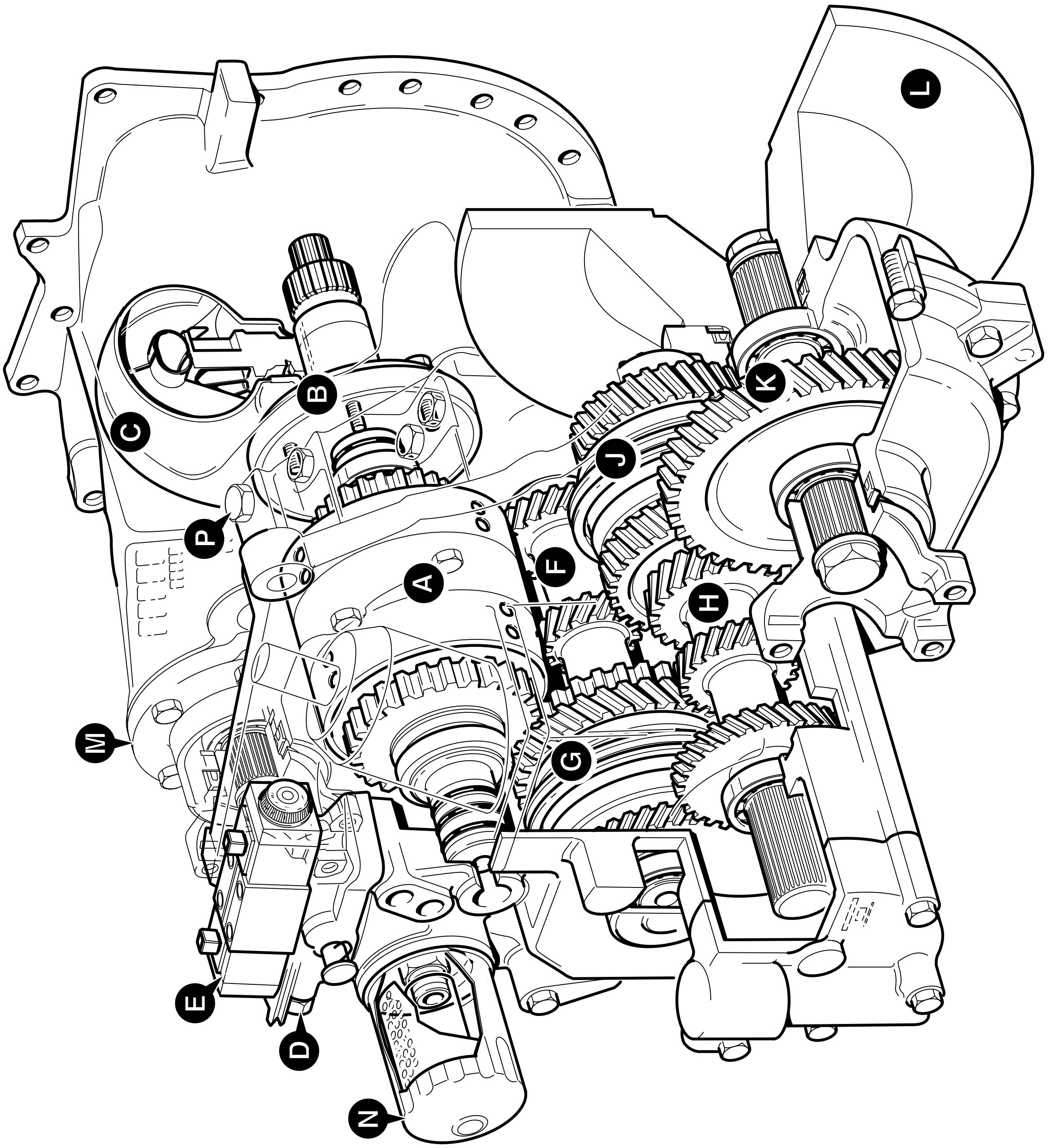
Low Emission Engines

		2CX 2CXL	2CXU 212SU
Engine Stall Speed			
1 Converter only	r.p.m.	2078	1576
2 MRV	r.p.m.	2121	2320
MRV (Loader)	r.p.m.		
MRV (Excavtor)	r.p.m.		
2 Converter + MRV (Loader)	r.p.m.	1825	1398
Build Specification			
Engine Size	66 bhp	•	
	75 bhp		•
Converter Type	SSL11 (2.8:1)	•	
	WH11 (2.4:1)		•









Syncro Shuttle Gearbox

Syncro Shuttle Gearbox

This Illustration shows a typical JCB Syncro Shuttle which consists of a torque converter, hydraulic forward/reverse unit, and integral manual 4-speed synchromesh gearbox.

The 4 gears are selected manually via a lever in the cab. Drive is transmitted in forward or reverse direction (in any gear) by means of the forward/reverse unit **A**. When reverse is selected, drive is transmitted via an idler gear which has the effect of reversing the gear train.

The forward/reverse unit **A** has a pair of hydraulically operated clutches giving forward - neutral - reverse drive. Oil pressure is provided by a crescent type pump **B** driven at engine speed by the drive lugs of the torque converter **C**. The oil pressure is controlled by maintaining valve **D**, and clutch selection is achieved by means of an electric solenoid valve **E**.

Drive is transferred from the forward/reverse unit by helical gears to the mainshaft **F**, which carries the 3rd/4th synchromesh unit **G**, and to the layshaft **H**, which carries the 1st/2nd synchromesh unit **J**. The synchromesh units are of the 'Blocking Pin' type, for a full detailed description refer to **Synchromesh - Description of Operation**.

Drive is transmitted finally via the output shaft **K** to the front and rear axles. The output shaft also incorporates a brake disc/calliper type parking brake **L**.

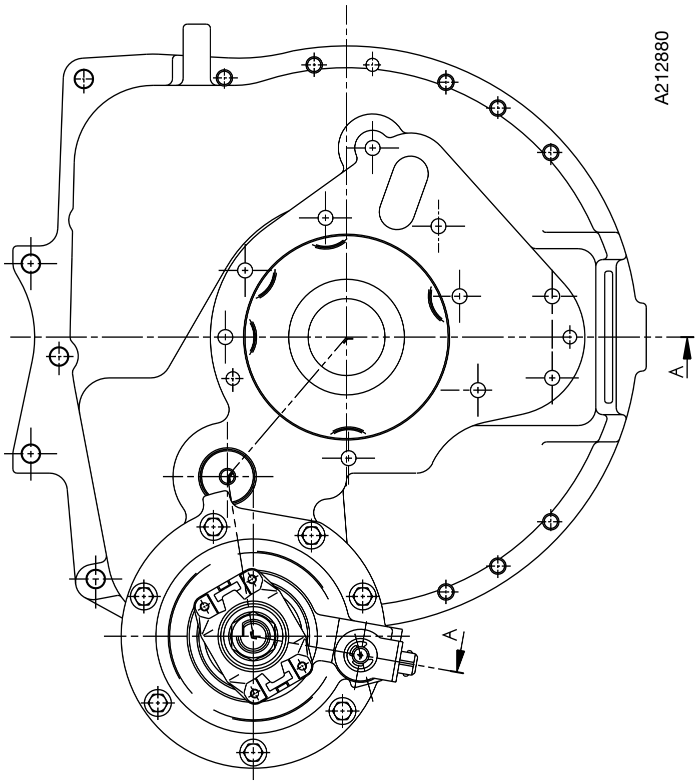
The illustration shows a gearbox which also incorporates a P.T.O. **M**, for a full detailed description refer to **Power Take Off Clutch - Operation.**
Note: The P.T.O. is not fitted on some machine variants.

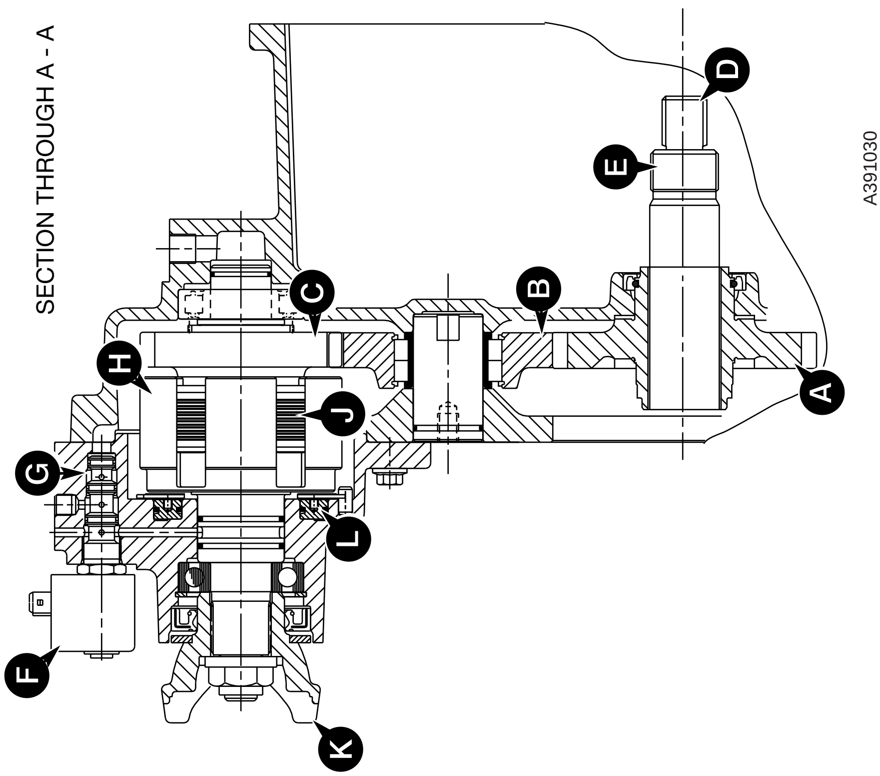
Component Identification

Key
A Forward/Reverse Clutch Unit
B Oil Pump
C Torque Converter
D Pressure Maintaining Valve
E Solenoid Valve
F Mainshaft
G 3rd/4th Synchromesh Unit
H Layshaft
J 1st/2nd Synchromesh Unit
K Output Shaft
L Brake Disc
M Power Take Off
N Oil Filter
P Pressure Relief Valve

Associated Components
S Oil Cooler (gearbox oil)
S1 Oil Temperature Sender
T Forward/Reverse/Neutral Control Lever (electrical)
U Gear Lever
V Transmission Dump Switch (electrical)
W Electrical Relays (solenoid valve)

Syncro Shuttle Gearbox - Power Take Off





Syncro Shuttle Gearbox - Power Take Off

The drive for the compressor or transfer gearbox is transmitted by constant mesh from gear **A** through idler gear **B** onto the power take off clutch gear **C**. Gear **A** is mounted on the input shaft **D** and is driven via the torque converter. The converter has an additional integral splined spigot when compared to a 'standard' converter, this additional spline is used to directly drive gear assembly **A** via splines **E**.

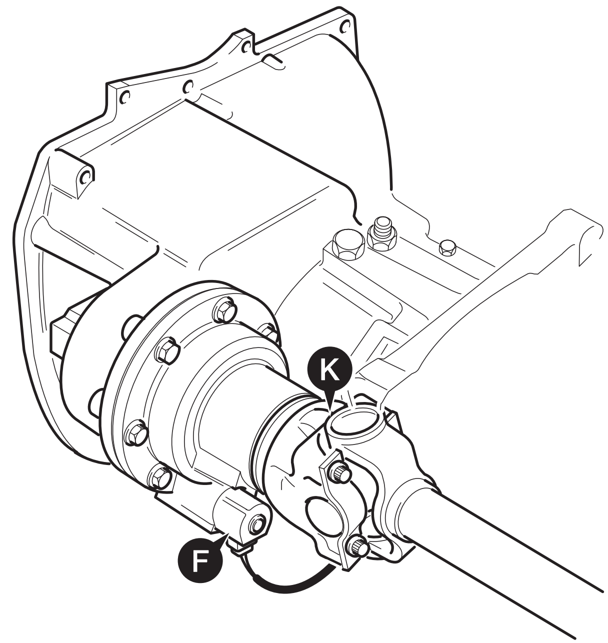
The constant meshing gears will freely rotate until the PTO clutch solenoid **F** is energised. When the solenoid is energised, pressurised oil is diverted via a solenoid spool **G** to the power take off clutch pack assembly **H**, engaging the clutch. Drive is transmitted to the PTO drive yoke **K**.

When the solenoid **F** is de-energised, the clutch is disengaged and the constant meshing gears will once again freely rotate (with no drive being transmitted). At the same time pressurised oil is diverted via the solenoid spool **G** to the back of piston **L,** applying the PTO brake. This prevents the yoke and its drive shaft rotating as soon as the operator disengages the PTO.

For more details of how the PTO clutch and brake systems work, see **Syncro Shuttle Gearbox - Hydraulic and Electrical Operation**

Component Identification

Key
A Drive Gear
B Idler Gear
C Clutch Gear
D Input Shaft
E Drive Gear Splines
F Solenoid Valve
G Solenoid Spool
H PTO Clutch
K PTO Drive Yoke
L PTO Brake Piston



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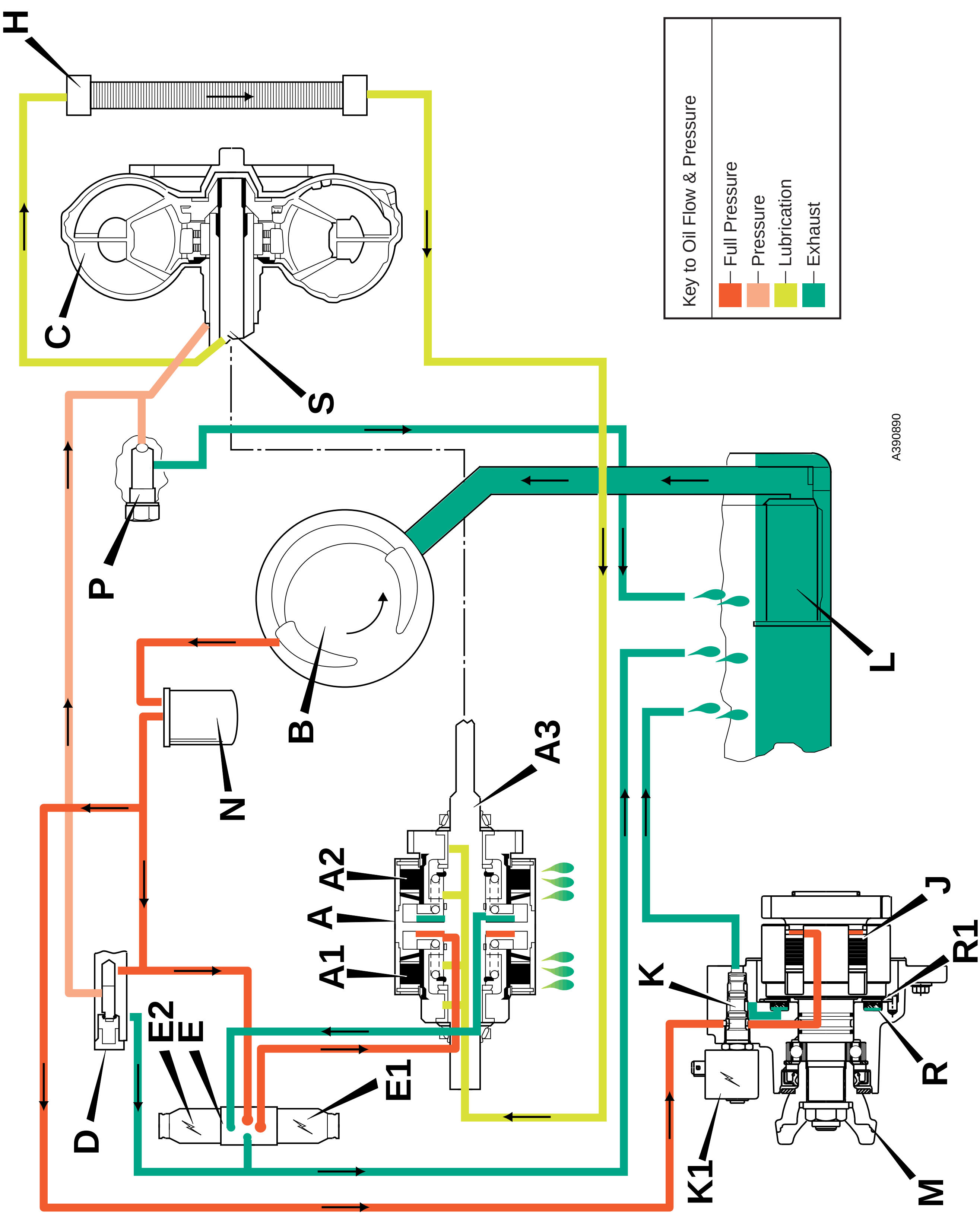

Key to Oil Flow & Pressure
Full Pressure
Pressure
Lubrication
Exhaust
H
C
S
P
B
N
D
E2
E
E1
A1
A
A2
A3
K
K1
J
R1
R
M
L
A390890

Syncro Shuttle Gearbox

Hydraulic and Electrical Operation

Oil is drawn from the gearbox sump via strainer **L** by pump **B**. Pressurised oil from the pump is fed through an internal passage via the filter **N** to the pressure maintaining valve **D**, which maintains pressure to the solenoid valve **E** for forward/reverse clutch selection. Excess oil from the maintaining valve flows back through casing cross drillings to the torque converter **C**. Oil enters the converter between the converter hub and the stator support, and leaves between the stator and the input shaft. Pressure in the converter is controlled by a relief valve **P** which dumps excess oil from the converter line back to the sump.

Oil from the torque converter flows out of the transmission to the external oil cooler **H**, returning at the rear of the transmission unit to pass through the centre of the input shaft **A3** for clutch lubrication. Oil then returns to the sump.

Solenoid Valve (**E**) **Operation**

Pressurised oil at the solenoid valve **E** is used to control the forward/reverse clutches **A1** and **A2**.

Forward:

In the diagram, electrical solenoid **E1** is energised by the forward/reverse control lever in the cab. Pressurised oil is diverted to the forward clutch **A1** and forward is selected. A restrictor orifice in the feed to the solenoid valve modulates the pressure to the clutch to smooth engagement. At the same time oil from reverse clutch **A2** is diverted back to the sump via solenoid valve **E**.

Reverse:

When the reverse is selected electrical solenoid **E2** is energised and pressurised oil is diverted to the reverse clutch **A2**. At the same time oil from clutch **A1** is diverted back to the sump

Neutral:

When neutral is selected (via the control lever or the transmission dump button), the flow of the pressurised oil is blocked at the solenoid valve. No solenoids are energised and no clutches engaged.

For a further detailed description refer to **Forward/Reverse Clutch - Operation**.

Power Take Off Operation (If fitted)

The PTO drive is controlled by a hydraulic clutch similar in design to the forward/reverse clutches. A hydraulic brake is also incorporated to prevent the drive shaft rotating when the PTO is deselected.

Pressurised oil is fed directly to the PTO solenoid control valve **K**.

PTO Drive Selected

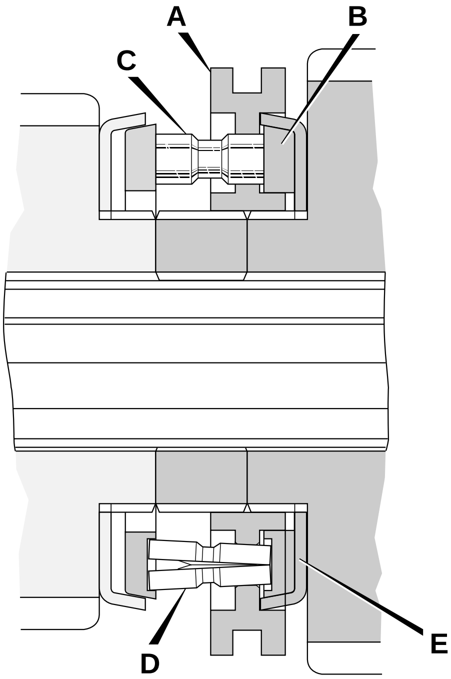
When the PTO drive is selected via a switch in the cab, the electrical solenoid **K1** is enegised. Pressurised oil is diverted to the clutch **J**, engaging drive to the output shaft **M**. At the same time oil from the brake piston **R** is diverted back to the sump, releasing the brake.

PTO Drive Deselected

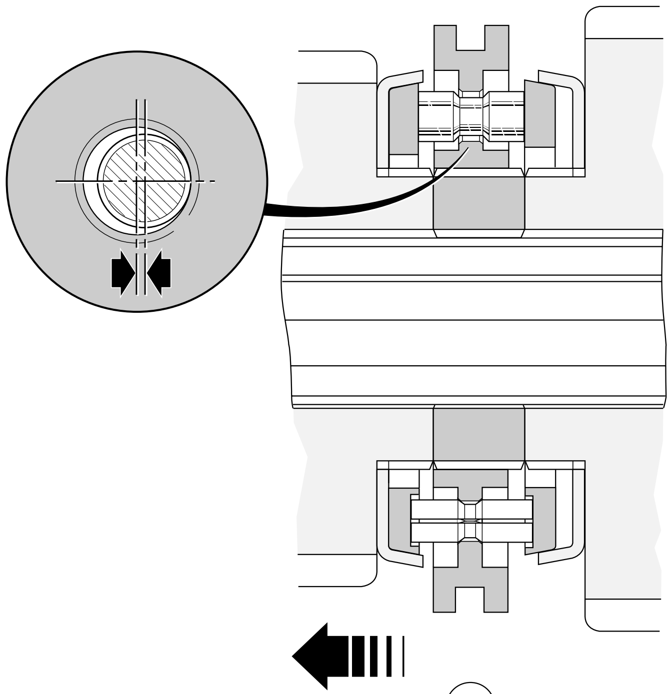
When the PTO drive is deselected via a switch in the cab, the electrical solenoid **K1** is de-energised. Pressurised oil is diverted to the brake piston forcing a brake disc **R1** onto the output shaft assembly **M**. At the same time oil from the clutch **J** is diverted back to the sump, disengaging the clutch.

Key
- **A** Forward/Reverse Clutch Unit
- **A1** Forward Clutch
- **A2** Reverse Clutch
- **A3** Input Shaft
- **B** Oil Pump
- **C** Torque Converter
- **D** Pressure Maintaining Valve
- **E** Solenoid Valve
- **E1** Electrical Solenoid - Forward
- **E2** Electrical Solenoid - Reverse
- **H** Oil Cooler
- **L** Oil Strainer
- **N** Oil Filter
- **P** Pressure Relief Valve (Torque Converter)

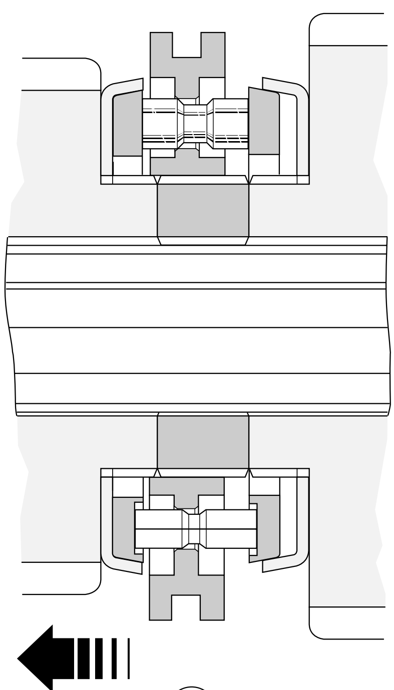
Key - Power Take Off Components (If fitted)
- **M** Output Shaft Assembly
- **J** PTO Clutch
- **K** Solenoid Valve
- **K1** Electrical Solenoid
- **R** Brake Piston
- **R1** Brake Disc



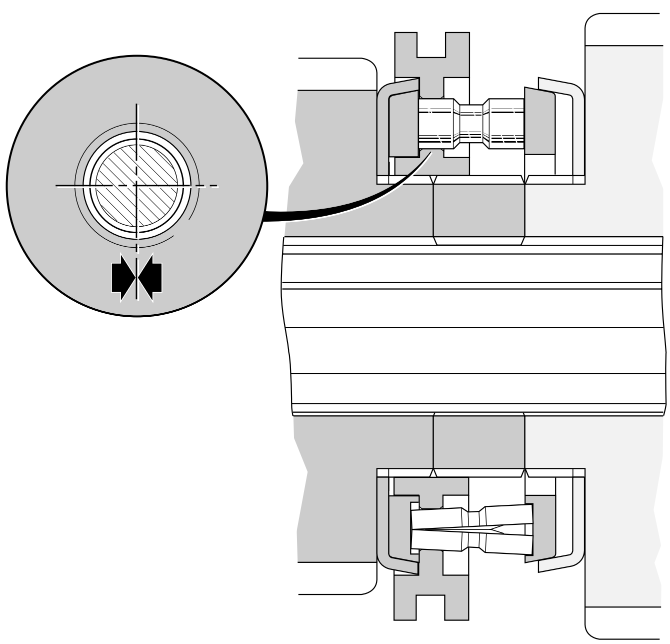
F



G



H



J

Syncro Shuttle Gearbox

Synchromesh - Operation

The gearbox is fitted with 'Blocking Pin' synchromesh, comprising the following parts.

SYNCRO HUB (A) controls the operation of the synchromesh unit and gear selection, the selector fork fitting into the outer groove. Internal dog teeth link the selected gear to the drive shaft. Through the syncro hub centre are two sets of holes for the blocker pins (**C**) and the split energiser pins (D), spaced alternately.

SYNCRO RINGS (B) are rigidly joined by the blocker pins, with the split energiser pins held, in counterbores, between the two syncro rings.

BLOCKER PINS (C) have a narrow neck in the centre, against which the syncro hub transmits radial drive during gear changes. The edges of the blocker pin neck and their mating syncro hub holes are designed so that, as the radial loads are reduced, the syncro hub can slide over the shoulder of the blocker pin.

SPLIT ENERGISER PINS (D) take the initial axial load of the syncro hub on the shoulder of the split energiser pin neck. As the axial load reaches approximately 400 N (40.8 kg; 90 lb) the internal springs allow the split energiser pin to collapse and the syncro hub to move axially.

SYNCRO CUPS (E) take the frictional drive from the syncro ring on their inner faces. The syncro cups are splined to drive their respective gears whilst synchronisation is taking place.

SYNCHROMESH - OPERATION

Diagram **F** shows the gearbox with first gear engaged. Syncro ring **B** is in contact with syncro cup **E** and the syncro hub dog teeth are linking first gear to the shaft gear. In this position the split energiser pins **D** are 'collapsed'.

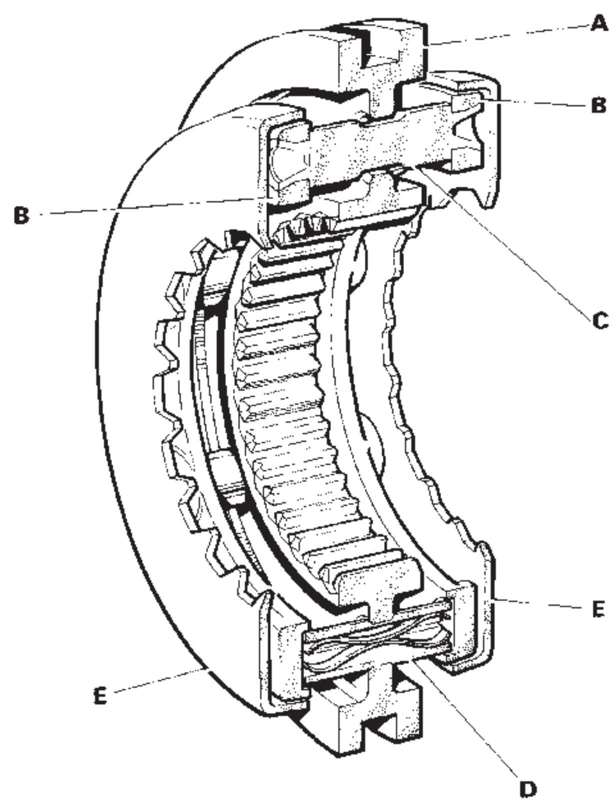
When selecting second gear the syncro hub **A** slides along the split energiser pins until the pin recess and the syncro hub flange are in line. At this point the split energiser pins open and the syncro rings are moved by the syncro hub pushing on the split energiser pin shoulder.

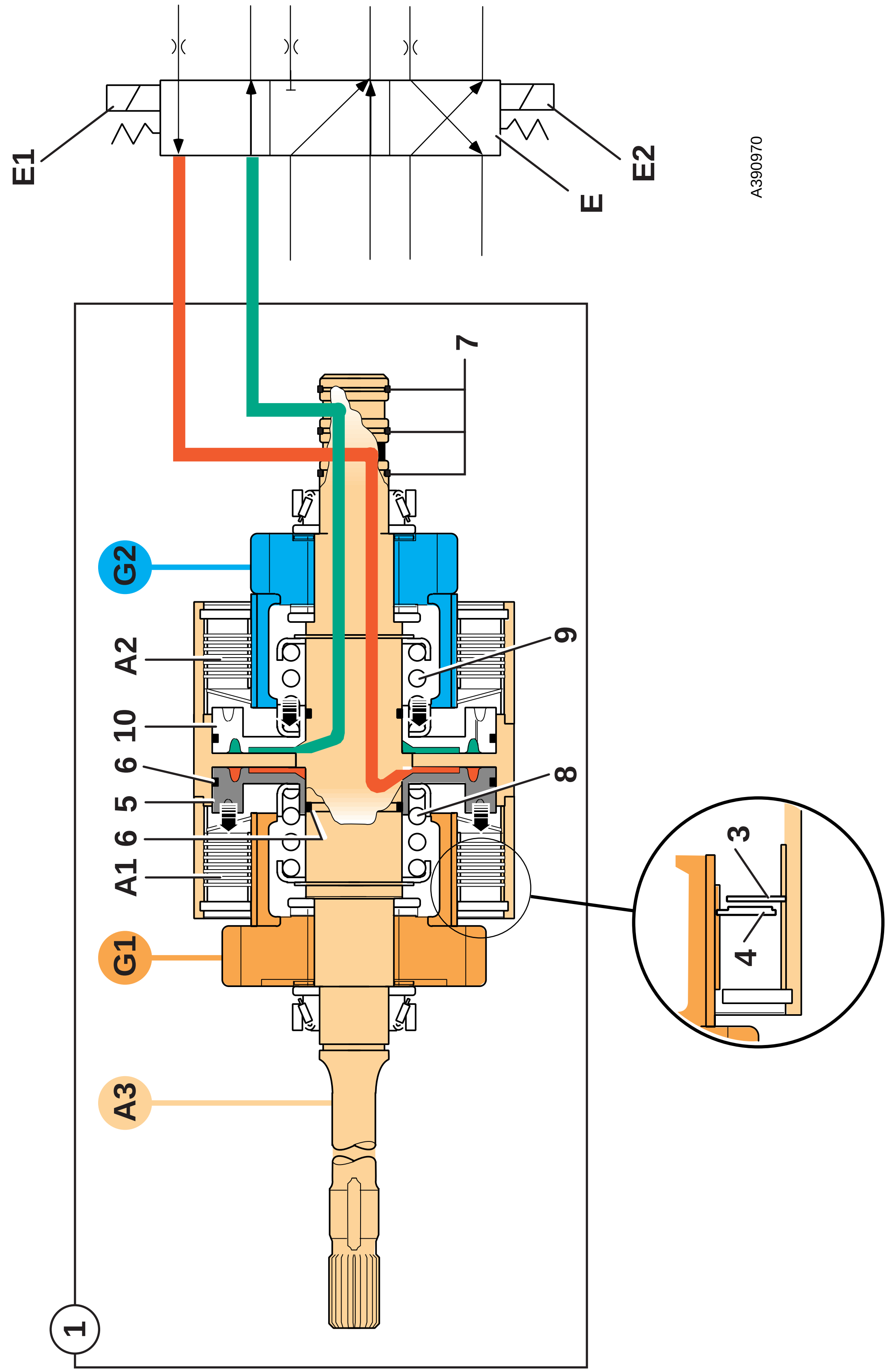
Initial contact between the syncro ring and the syncro cup starts to synchronise the speed of the shaft and second gear. The rotational force of the syncro ring is taken by the blocker pin against the edge of the syncro hub hole, as at **G**.

As the axial load on the syncro hub increases, the split energiser pin 'collapses' and the conical faces of the blocking pin and syncro hub hole come into contact, as at **H**.

Further increases in the axial loads increase the frictional grip of the syncro ring and the syncro cup, causing the shaft and gear speeds to synchronise.

As the speeds are synchronised the radial load on the blocker pin and the syncro hub is reduced. This allows the syncro hub to slide freely along the blocker pin and engage its dog teeth with second gear, see diagram **J**.





**Syncro Shuttle Gearbox -
Forward/Reverse Clutch Operation**

Syncro Shuttle Gearbox
Forward/Reverse Clutch Operation

The forward/reverse clutch unit **1** transfers drive from the input shaft **A3** to either gear **G1** or gear **G2** depending on which of the two clutches (**A1** or **A2**) is engaged, giving forward or reverse drive. When neither clutch is engaged, neutral is selected.

The clutches are of the wet, multi-plate type.

The clutch housings and input shaft are a one piece assembly **A3**. The assembly is permanently driven by the engine via the torque converter. Clutch counter plates **3** are also permanenty driven via meshing teeth inside the clutch housings.
Clutch friction plates **4** are meshed with the gear/plate carriers (**G1** and **G2**).

In the diagram, clutch **A1** is engaged. The counter plates **3** and friction plates **4** are pressed together by hydraulically actuated piston **5**. Drive is then transmitted from the input shaft to the gear **G1**.
Clutch **A2** is disengaged and no drive is transmitted to gear/plate carrier **G2**. The gear is also free to rotate on the input shaft assembly.

Actuation of the hydraulic pistons **10** and **5** is controlled via three position solenoid valve **E**† .
When neutral is selected, solenoids **E1** and **E2** are deactivated and the flow of pressurised oil to the clutches is blocked. Springs **8** and **9** move the pistons away from the clutch plates and oil from both pistons is vented to the sump.
When either forward or reverse is selected, the solenoid valve **E** diverts pressurised oil via cross drillings inside the input shaft **A3** to the appropriate clutch (piston **10** or **5**) in the unit. Pressure from the other clutch is vented to the sump via the solenoid valve spool. Oil is prevented from leaking by seals **6** on the pistons and ring seals **7** on the input shaft **A3**.

† The valve **E** is shown using symbols. For an explanation of how the symbols work, see **Section E**, **Introduction to Hydraulic Schematic Symbols**.

Syncro-Shuttle Gearbox - Hydraulic

Before commencing with the fault finding procedure make sure that the correct type of transmission fluid has been used.

LACK OF POWER

Possible Cause	Remedy
1 Poor engine condition.	1 Check and if necessary repair engine.
2 Low oil level.	2 Top up system.
3 Worn pump.	3 Check flow and if necessary repair or renew pump.
4 Torque converter damage.	4 Check and if necessary repair or renew torque converter.
5 Low mainline pressure.	5 See fault 'Low Mainline Pressure'.
6 Clutches slipping.	6 See fault 'Low Clutch Pressure'.
7 Internal leakage.	7 a) Check internal cored galleries and casting for porosity. b) Check condition of seals.
8 High stall speeds.	8 See fault 'High Stall Speeds'.
9 Low stall speeds.	9 See fault 'Low Stall Speeds'.
10 Overheating.	10 See fault 'Overheating'.

LOW MAINLINE PRESSURE (in neutral)

Possible Cause	Remedy
1 Worn pump.	1 Check flow and if necessary repair or renew pump.
2 Blocked suction strainer.	2 Clean suction strainer.
3 Pressure maintaining valve sticking/leaking.	3 Free off or renew valve.
4 Oil aerated (foaming).	4 a) Internal leakage (cored galleries) - inspect/repair transmission. b) Dirty suction strainer - clean strainer. c) High oil level - drain to proper level. d) Incorrect grade of oil - drain then refill with correct oil.

HIGH STALL SPEEDS (Forward & Reverse Clutches)

Possible Cause	Remedy
1 Damaged converter blades.	1 Check and if necessary renew converter.
2 Clutches slipping.	2 See fault 'Low Clutch Pressure'.
3 Internal leakage.	3 a) Check internal cored galleries and casting for porosity. b) Check condition of seals.

LOW STALL SPEEDS (Forward & Reverse Clutches)

Possible Cause	Remedy
1 Poor engine condition.	1 Check and if necessary repair engine.
2 Torque converter reaction member clutch slipping.	2 Check and if necessary renew torque converter.

LOW CONVERTER OUT PRESSURE

Possible Cause	Remedy
1 Low mainline pressure.	1 See fault heading 'Low Mainline Pressure'.
2 Converter internal leakage.	2 Check and if necessary renew converter.
3 Converter relief valve faulty.	3 Check and if necessary repair relief valve.
4 Restriction in converter feed.	4 See item 10 in fault 'Overheating'

LOW PUMP FLOW

Possible Cause	Remedy
1 Low oil level.	1 Top up system.
2 Blocked suction strainer.	2 Clean suction strainer.
3 Worn pump.	3 Repair or renew pump.

Syncro-Shuttle Gearbox - Hydraulic (cont'd)

HIGH CONVERTER OUT PRESSURE

Possible Cause		Remedy	
1	Oil cooler/lines blocked.	1	Clean cooler, free blockage.
2	Converter in pressure incorrect	2	Check converter in pressure correct
3	Converter relief valve faulty.	3	Check and if necessary repair relief valve.

LOW LUBRICATION PRESSURE

Possible Cause		Remedy	
1	Low mainline pressure.	1	See fault heading 'Low Mainline Pressure'.
2	Oil cooler/lines blocked.	2	Clean cooler, free blockage.
3	Ruptured lubrication line.	3	Repair line.
4	Converter internal leakage.	4	Check and if necessary renew converter.
5	Converter relief valve faulty.	5	Check and if necessary repair or renew relief valve.
6	Leak at pump to case joint (indicated by low cooler flow)	6	Check and if necessary repair or replace as necessary.
7	Restriction in converter feed	7	See item10 in fault 'Overheating'

LOW CLUTCH PRESSURE AND/OR CLUTCH SLIPPING

Possible Cause		Remedy	
1	Low mainline pressure.	1	See fault heading 'Low Mainline Pressure'.
2	Worn pump.	2	Check flow and if necessary repair or renew pump.
3	Blocked restrictor orifice in F/R solenoid valve block. (Both F/R clutches will indicate low pressure).	3	Remove F/R solenoid and clear restriction in solenoid valve block.
4	Clutch seals worn.	4	Confirm with a clutch leak test, if required renew clutch seals
5	Clutch piston rings worn.	5	Confirm with a clutch leak test, renew piston rings.
6	Mechanical failure.	6	Strip and rebuild clutch, renew parts as required.

LOW COOLER FLOW

Possible Cause		Remedy	
1	Converter relief valve faulty.	1	Check and if necessary repair or renew relief valve.
2	Leak at pump to case joint .	2	Check and if necessary repair or replace as necessary.
3	Worn pump.	3	Check flow and if necessary repair or renew pump.
4	Internal leakage.	4	a) Check internal cored galleries and casting for porosity. b) Check condition of seals.
5	Restriction in converter feed.	5	See item 10 in fault 'Overheating'.

OVERHEATING

Possible Cause		Remedy	
1	Low oil level.	1	Top up system.
2	High oil level.	2	Drain oil to correct level.
3	Trapped or kinked hoses in cooler system.	3	Renew or repair hoses.
4	Low converter out pressure and flow rate.	4	Repair or renew the converter relief valve.
5	Oil cooler blocked.	5	Clean cooler.
6	Operating in wrong gear range.	6	Select correct gears to suit working conditions.
7	Water system overheating. low water level etc.	7	Rectify water system problems, eg radiator, cooler lines,
8	Oil aerated (foaming).	8	See fault 'Low Mainline Pressure', item 4.
9	Clutch piston(s) sticking on return stroke.	9	Check and repair clutch piston(s) and seal(s).
10	Cored galleries on front housing pump mounting face wrong depth (indicated by excessively low pressure and flow on converter out cooling line).	10	Replace front housing (or rectify existing housing).
11	Leakage across pump mounting face and front case. loose	11	Check for damaged surface on both components and pump mounting bolts.

Syncro Shuttle Gearbox - Mechanical

Before carrying out the checks listed the machine should, if possible, be operated to determine the fault area(s), and bring the systems to their normal working temperatures. Ensure that the correct quantity and grade of oil is used and that there are no obvious leaks.

A If the transmission is noisy, start at check 1.

B If the transmission is overheating, start at check 4.

C If the transmission will not pull, start at check 12.

D If there is no drive in one or both directions, start at check 17.

E If the transmission is jumping out of gear, start at check 29.

F If the transmission is sticking in gear, start at check 39.

G If ratios are 'crash changing', start at check 41.

CHECK			ACTION
1	Is there noise when selecting direction?	YES: NO:	Check 3 Check 2
2	Is there noise when running with direction selector in neutral and ratio selector in a gear?	YES: NO:	Check 9 Check 19
3	Is there air in the hydraulic system?	YES: NO:	Continue running to expel air. Check 4
4	Is the fluid level correct?	YES: NO:	Check 5 Check level only when machine is cold and top-up as required.
5	Are the oil passages restricted?	YES: NO:	Clear the restriction. Check 6
6	Is the suction strainer restricted?	YES: NO:	Remove and clean strainer. Check 7
7	Is pump pressure as specified?	YES: NO:	Check 9 Check clutch pressure maintenance valve is free to operate.
8	When flow testing pump, is output low?	YES: NO:	Renew pump. Check converter sprag clutch for wear or slip.
9	Does the noise continue when direction selector is in forward or reverse?	YES: NO:	Check 10 Check 11
10	Is transmission misaligned?	YES: NO:	Renew mountings and check position. Check 'converter out' pressure and flow.
11	Are the pump bushes worn?	YES: NO:	Renew Check converter for wear or cooler for restriction to flow.
12	Is the transmission not pulling in one direction only?	YES: NO:	Check 16 Check 13
13	Is the transmission not pulling in both Forward and Reverse?	YES: NO:	Stall test machine, Check 14. Check 16

Syncro Shuttle Gearbox - Mechanical (cont'd)

CHECK			ACTION
14	Is 'converter in' pressure as specified?	YES: NO:	Check 15 Inspect converter relief valve for damage. Check cooler bypass relief valve pressure setting.
15	Is pump being driven by converter?	YES: NO:	Check pump pressure. Renew damaged parts.
16	Are clutch sealing rings damaged?	YES: NO:	Tap pressure gauge into clutch feed lines to monitor pressure. Check clutch plates for damage.
17	Is there drive in one direction only?	YES: NO:	Check 19 Check 18
18	Is the start switch in the run position and supplying current to the neutral start relay?	YES: NO:	Check 19 Rectify.
19	Is the fault only when the transmission is hot?	YES: NO:	Dismantle solenoid and check components. Check microswitches, relay and wiring loom.
20	Is the noise a growl, hum or grinding?	YES: NO:	Check gears for damage or wear. Check 21
21	Is the noise a hiss, thump or bumping?	YES: NO:	Check bearings for damage or wear. Check 22
22	Is the noise a squeal?	YES: NO:	Check free running gears for seizure. Check 23
23	Is the noise present when in neutral or when in gear?	NEUTRAL: IN GEAR:	Check 24 Check 27
24	Is the countershaft or its bearings worn or damaged?	YES: NO:	Renew damaged parts. Check 25
25	Is there excessive backlash in the gears?	YES: NO:	Adjust by checking shaft end float. Check 26
26	Is the mainshaft pilot bearing worn?	YES: NO:	Renew. Check gear teeth for scuffing.
27	Is the mainshaft rear bearing worn?	YES: NO:	Renew. Check 28
28	Are the sliding gear teeth worn or damaged?	YES: NO:	Renew gears. Check 29
29	Are the selector forks loose?	YES: NO:	Tighten screws. Check 30
30	Are the selector fork pads or grooves in gears worn?	YES: NO:	Renew worn parts. Check 31
31	Are the dog gear teeth worn?	YES: NO:	Renew. Check 32
32	Are the selector rod detent springs broken?	YES: NO:	Renew. Check 33

Syncro Shuttle Gearbox - Mechanical (cont'd)

CHECK		ACTION
33 Are the selector rods worn or damaged?	YES: NO:	Renew. Check 34
34 Are the selector fork pads out of position?	YES: NO:	Reposition or renew (check interlock). Check 35
35 Is there excessive end float in gears or shafts?	YES: NO:	Adjust. Check thrust washers and mating faces.
36 Is the synchroniser bronze worn?	YES: NO:	Renew synchro pack. Check 37
37 Are steel chips embedded in the bronze?	YES: NO:	Continue using, chips will either embed below bronze or be rejected. Check 38
38 Are the synchroniser components damaged?	YES: NO:	Renew. Check free running gears for seizure or damage.
39 Are the sliding gears tight on the splines?	YES: NO:	Free or renew. Check 40
40 Are chips wedged between splines of shaft or gear?	YES: NO:	Remove chips. Ensure that clutch is disengaged when dump pedal is pressed.
41 Are steel chips embedded in the bronze?	YES: NO:	Continue using, chips will either embed below bronze or be rejected. Check 42
42 Are the synchroniser spring pins damaged?	YES: NO:	Renew synchro. Check 43
43 Is the synchroniser bronze worn?	YES: NO:	Renew synchro. Check blocker pins.

Power Take-Off Clutch

FAULT	POSSIBLE CAUSE	ACTION
A PTO shaft does not turn.	1 Solenoid valve faulty.	1 Dismantle solenoid valve and check component parts, renew valve if necessary.
	2 Solenoid not energising.	2 Check electrical connections, switch, relay and wiring loom.
	3 Insufficient hydraulic pressure.	3 Check hydraulic pressure at test point.
	4 PTO brake not releasing/siezed.	4 Check.
B Excessive PTO noise in operation.	1 Friction/counter plates in poor condition/distortion.	1 Renew friction/counter plates.

Front and Rear Axle - Renewing the Pinion Oil Seal

The pinion oil seal **4** may be renewed without removing the axle from the machine.

⚠ WARNING

A raised and badly supported machine can fall on you. Position the machine on a firm, level surface before raising one end. Ensure the other end is securely chocked. Do not rely solely on the machine hydraulics or jacks to support the machine when working under it.

Disconnect the battery, to prevent the engine being started while you are beneath the machine.
GEN-001

1 Remove the roadwheels and uncouple the axle propshaft. Measure the axle rolling torque and record the reading.

2 Using Service Tool 892/00812, remove the drive yoke **1** together with its stake nut **2**.

3 Remove the seal **4** and fit a new one. Pack between the lips of the new seal with grease before fitting.

4 Fit the coupling yoke, and a new stake nut:

- **a** Using Service Tool 892/00812, tighten the nut to 200 Nm (148 lbf ft; 20.4 kgf m).

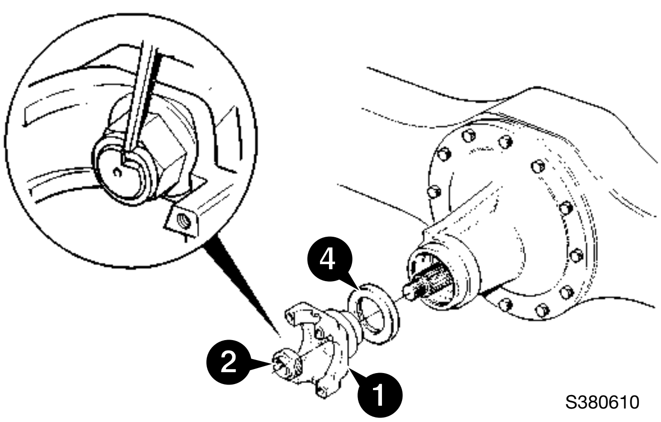
- **b** Measure the rolling torque. The reading should be 0.5 to1Nm (0.37 to 0.74lbf ft; 0.05 to 0.1kgf m) more than that recorded in Step 1.

- **c** Progressively torque tighten nut to achieve correct rolling torque or a maximum of 300Nm (287 lbf ft).

Note: If the rolling torque figure (new pinion seal fitted) exceeds the reading recorded in step 1 by 1Nm (0.74 lbf ft; 0.1 kgf m) or more, this would indicate that a collapsible spacer has been fitted which MUST be renewed.

- **d** Stake the nut using a square ended staking tool.

5 Refit the roadwheels and couple the propshaft.



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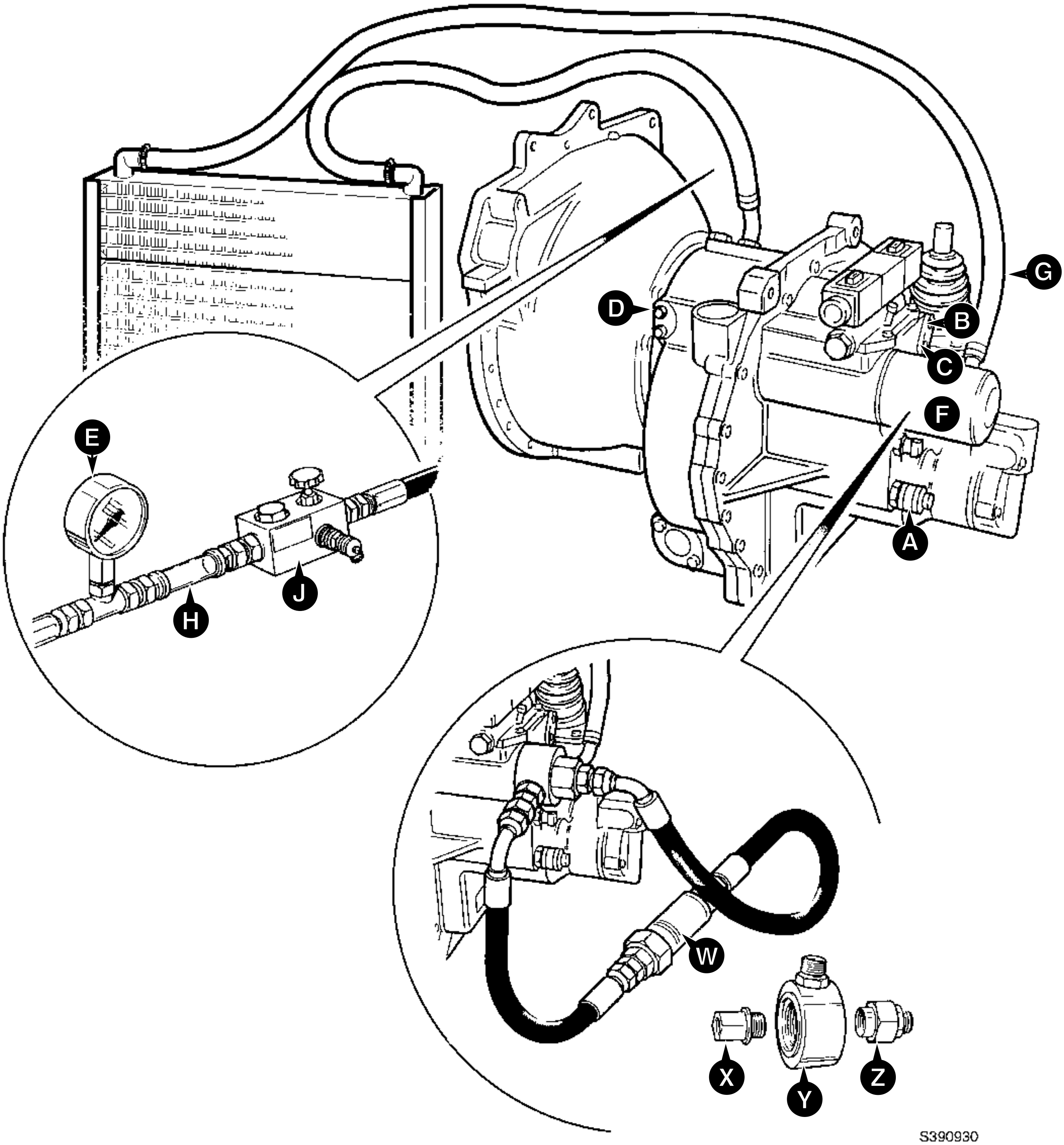
Brakes

Testing for Piston Seal Leakage

Instructions for piston seal leakage tests are described in the brakes section, refer to Section G **Service Procedures, Service Brakes - Brake Piston Seal Leakage Test**.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Pressure and Flow Tests

Before completing any of the transmission pressure/flow tests, make sure that the oil level is correct and at normal operating temperature.

All gauges etc used in the following pressure/flow tests are shown in **Service Tools - Syncro Shuttle Gearbox**.

⚠ WARNING

Fine jets of hydraulic oil at high pressure can penetrate the skin. Do not use your fingers to check for hydraulic oil leaks. Do not put your face close to suspected leaks. Hold a piece of cardboard close to suspected leaks and then inspect the cardboard for signs of hydraulic oil. If hydraulic oil penetrates your skin, get medical help immediately.

HYD 1-1

⚠ WARNING

Take care when disconnecting hydraulic hoses and fittings as the oil will be HOT.

Trans 1-2

⚠ WARNING

DO NOT go underneath the machine with the engine running. Switch off the engine, apply the parking brake and chock both sides of all wheels before going underneath the machine.

Trans 2-1

TEST POINTS

A - Mainline pressure

B - Forward clutch pressure

C - Reverse clutch pressure

D - Converter inlet/converter relief valve pressure

E - Converter outlet pressure

F - Pump flow (remove filter and fit adapters)

G - Lubrication pressure

H - Cooler flow (flowmeter in line from transmission to cooler)

J - Load Valve

If testing the complete transmission, the following procedures are listed in a logical sequence and should therefore be completed in the same sequence. Also, refer to the **Fault Finding** procedures at the beginning of the transmission section for reference to specific tests.

Mainline Pressure

1 Stop engine, connect a 0-20 bar (0-300 lbf/in^2) pressure gauge to test connector **A**.

2 Start engine and run at 1000 rev/min. With the transmission in neutral the pressure gauge will show the **Mainline Pressure** which should be as given in **Technical Data**.

3 Repeat step 2 and note gauge readings with engine running at 2000 rev/min.

4 Stop engine and remove test gauge.

If the mainline pressure is low, refer to **Fault Finding** 'Low Mainline Pressure' for a list of possible reasons. A high reading could indicate a faulty pressure maintenance valve.

Clutch Pressure (Forward Clutch Given in Example)

1 Stop engine, connect a 0-20 bar (0-300 lbf/in^2) pressure gauge to test connector **B** (item **C** for reverse clutch).

2 Start engine and run at 1000 rev/min. With parking brake and footbrake firmly applied, select **Forward**, the pressure gauge will show the **Clutch Pressure** which should be as given in **Technical Data**.

Note: If the mainline pressure is in the lower part of the tolerance band (refer to **Technical Data**), then the forward and reverse clutch pressures should also be in the lower part of the tolerance band and vice versa.

3 Repeat step 2 and note gauge readings with engine running at 2000 rev/min.

4 Stop engine and remove test gauge.

If the clutch pressure is low, the clutch could be leaking. A leaking clutch is easier to detect when the engine is running at idle. With the engine at idling speed, check the mainline pressure and then check the clutch pressure as described above, if the clutch pressure is 1.7 bar (25 lbf/in^2) less than the mainline pressure, then the clutch is probably leaking. Refer to **Fault Finding** 'Low Clutch Pressure', before dismantling the clutch.

A high reading could indicate a faulty pressure maintaining valve.

Pressure and Flow Tests (continued)

Pump Flow

1 Stop engine, remove transmission filter **F**, and screw adapter **X** (service tool 892/00304) on to the threaded spigot. Fit test adapter **Y** (service tool 892/00301) and secure with adapter **Z** (service tool 892/00302). Connect flowmeter **W** (service tool 892/00229).

2 Start engine and run at 1000 rev/min. With the transmission in neutral the flowmeter will show the **Pump Flow** which should be as given in **Technical Data**.

3 Repeat step 2 and note gauge readings with engine running at 2000 rev/min.

4 Stop engine and remove test adapters, refit filter.

If the pump flow is low, refer to **Fault Finding** 'Low Pump Flow'.

Converter Out Pressure/Oil Cooler Flow Rate

1 Stop engine, connect a 0-10 bar (0-145 lbf/in^2) pressure gauge and flowmeter (see note) into the converter out line as shown at **E** and **H** respectively.

Note: The flowmeter must have a low back pressure, otherwise an incorrect reading will be obtained.

2 Run the engine at 1000 rev/min with transmission in neutral. The pressure gauge indicates the **Converter Out Pressure** and the flowmeter indicates the **Oil Cooler Flow Rate**, both readings should be as given in **Technical Data**.

3 Repeat step 2 and note gauge readings with engine running at 2000 rev/min.

4 Stop engine, remove test gauges and refit hoses to original position.

If the pressure is low, refer to **Fault Finding** 'Low Converter Out Pressure' for a list of possible reasons. A high pressure together with low flow could be caused by a blocked oil cooler.

Converter In Pressure

1 Stop engine, connect a 0-10 bar (0-145 lbf/in^2) pressure gauge to test point **D**.

2 Start the engine and run at 1000 rev/min. With the transmission in neutral the pressure gauge will show Converter In Pressure which should be as given in **Technical Data**. A high or low reading could indicate a faulty converter relief valve, or a problem with the pump.

3 Remove pressure test gauge.

Converter Relief (Safety) Valve Pressure

1 Connect a 0-10 bar (0-145 lbf/in^2) pressure gauge to test point **D**.

2 Fit a load valve **J** into the converter out line.

CAUTION: Make sure the load valve is in the OPEN position (the adjusting knob screwed fully out) before starting the following pressure test. If the load valve is not fully open, damage to the converter seals will be incurred.

CAUTION: DO NOT allow the pressure to exceed 7.6 bar (110 lbf/in^2) or damage to the converter seals will be caused.

3 Start the engine and run at 1000 rev/min. With the transmission in neutral, slowly screw down the load valve **J** whilst observing the gauge reading which should rise to the **Converter Relief (Safety) Valve** setting as given in **Technical Data**.

4 If the reading is higher than specified then the converter relief valve is faulty. A low reading indicates a leaking pump seal or a faulty converter relief valve.

5 Stop engine, remove test gauges and refit hoses to original position.

Lubrication Pressure

1 Stop engine, connect a suitable pressure gauge into the return line from the oil cooler to the transmission as shown at **G**.

2 Start the engine and run at 1000 rev/min. With the transmission in neutral the pressure gauge will indicate the **Lubrication Pressure** which should be as given in **Technical Data**.

3 Repeat step 2 and note gauge readings with engine running at 2000 rev/min.

4 Stop engine and remove pressure gauge.

Solenoid Valve

Dismantling and Assembly

The numerical sequence shown on the illustration is intended as a guide to dismantling.

For assembly the sequence should be reversed.

For clarity, only one solenoid has been numbered in the dismantling sequence.

Dismantling

1 Remove the surface mounted ‘O’ rings **1**.

2 Unscrew the knurled nut **2** and remove O-ring **3**, withdraw the solenoid **4** and O-ring **5**.

3 Hold the solenoid valve body **6** in a vice, using the spanner flats **A**, remove spindle **7** and O-ring **8.**

4 Pull out actuating pin **9**, spring **10**, spring retainer **11** and spool **12**.

5 Dismantle the opposite solenoid in the same sequence as described above.

6 Inspect the spool and spool bore for signs of wear, nicks scratches etc.

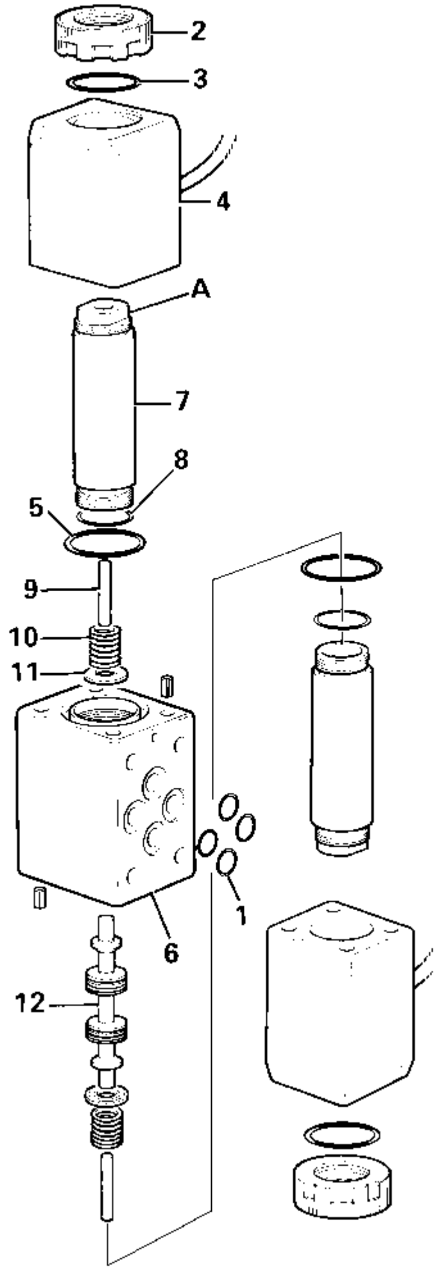
Assembly

1 Renew all O-rings.

2 Lightly lubricate all parts with clean transmission fluid before assembling.

3 Check that the flying leads are secure and that the connectors are intact.

4 Apply a small quantity of JCB Threadlocker & Sealer to the threads in the knurled nut **2** before fitting.



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Torque Converter Stall Test

Note: Before completing the torque converter stall test, make sure that the mainline and clutch pressures are correct. If the pressures are incorrect, the clutches could slip, causing premature wear of the clutch friction plates.

Also, make sure that the machine neutral circuit pressure (including steer circuit) is correct (14 bar; 200 lbf/in^2 maximum).

1 Ensure that the engine and transmission are at normal working temperature. Run engine at maximum speed and check the **No Load Speed (High Idle Speed - U.S.A).** See **Engine Technical Data** for correct figure; adjust if necessary.

2 Apply parking brake **A** and footbrake firmly **B**, select 4th Speed Forward and open throttle **C** fully. Engine speed should be as specified at **Torque Converter Stall** in **Transmission Technical Data**. Select Reverse and repeat test.

Note: When fully engaged, the parking brake electrically disconnects the transmission drive; this prevents the machine from being driven with the parkbrake on. Therefore, so that we can complete the test, move the parkbrake lever fractionally forward until the warning light is just extinguished; hold the lever in this position for the duration of the test. DO NOT move the lever too far forward, otherwise the parkbrake will not be fully operational. Alternatively, disconnect the switch at the park brake.

DO NOT stall the converter for longer than 30 seconds or the transmission fluid will overheat.

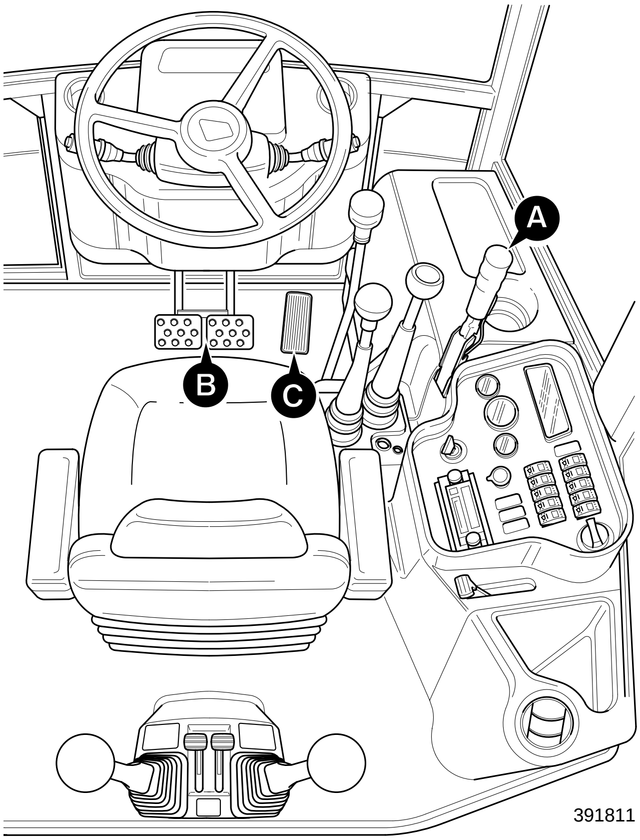
3 If engine speeds are higher than the stated figures check the transmission for clutch slippage or internal leakage.

If engine speeds are below the stated figures either the engine is losing power and should be serviced/overhauled or the torque converter reaction member clutch is slipping.

To check the engine, make sure the main relief valve is set correctly, select Neutral, open throttle fully and operate an excavator service to 'blow off' the main relief valve. Engine speed should fall to slightly above the **Maximum Governed Speed** (see **Engine Technical Data**). If engine speed is correct the torque converter is faulty.

Note 1: The engine can also be checked by doing a stall test and 'blowing off' the main relief valve simultaneously. The speed should be as stated in **Technical Data, Torque Converters (Converter + MRV)**

Note 2: Maximum Governed Speed is a datum figure only. It cannot be adjusted or checked with the engine installed in the machine.



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Removing and Replacing

When Removing

Before removing propshafts always mark both companion flanges and also mark the sliding joints prior to removal.

When Replacing

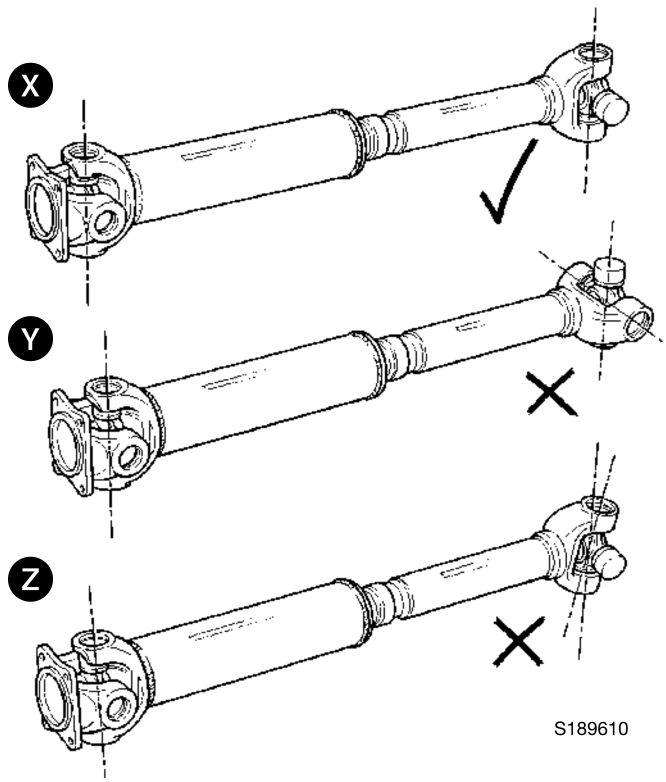
Upon assembly, after lubricating sliding joints with JCB MPL Grease, align the shafts against identification marks previously made or, in the case of a shaft being renewed, use the manufacturer's alignment markings.

Retaining straps **C** stretch with use, therefore these straps must always be replaced with new ones.

Apply JCB Threadlocker and Sealer to threads of all flange bolts.

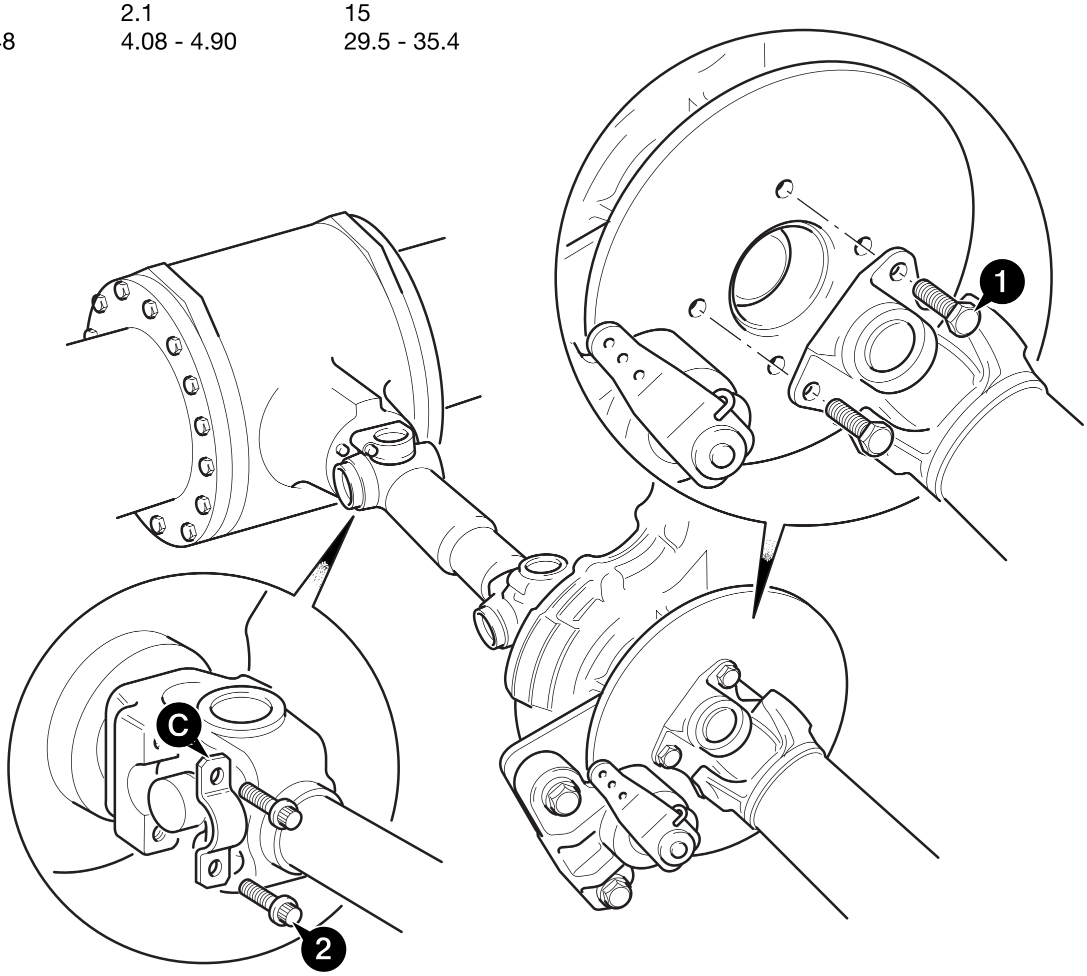
Note: Propshafts should be installed with their main shaft sections fitted to the axle end, and their sliding sections fitted to the transmission 4 wheel drive unit.

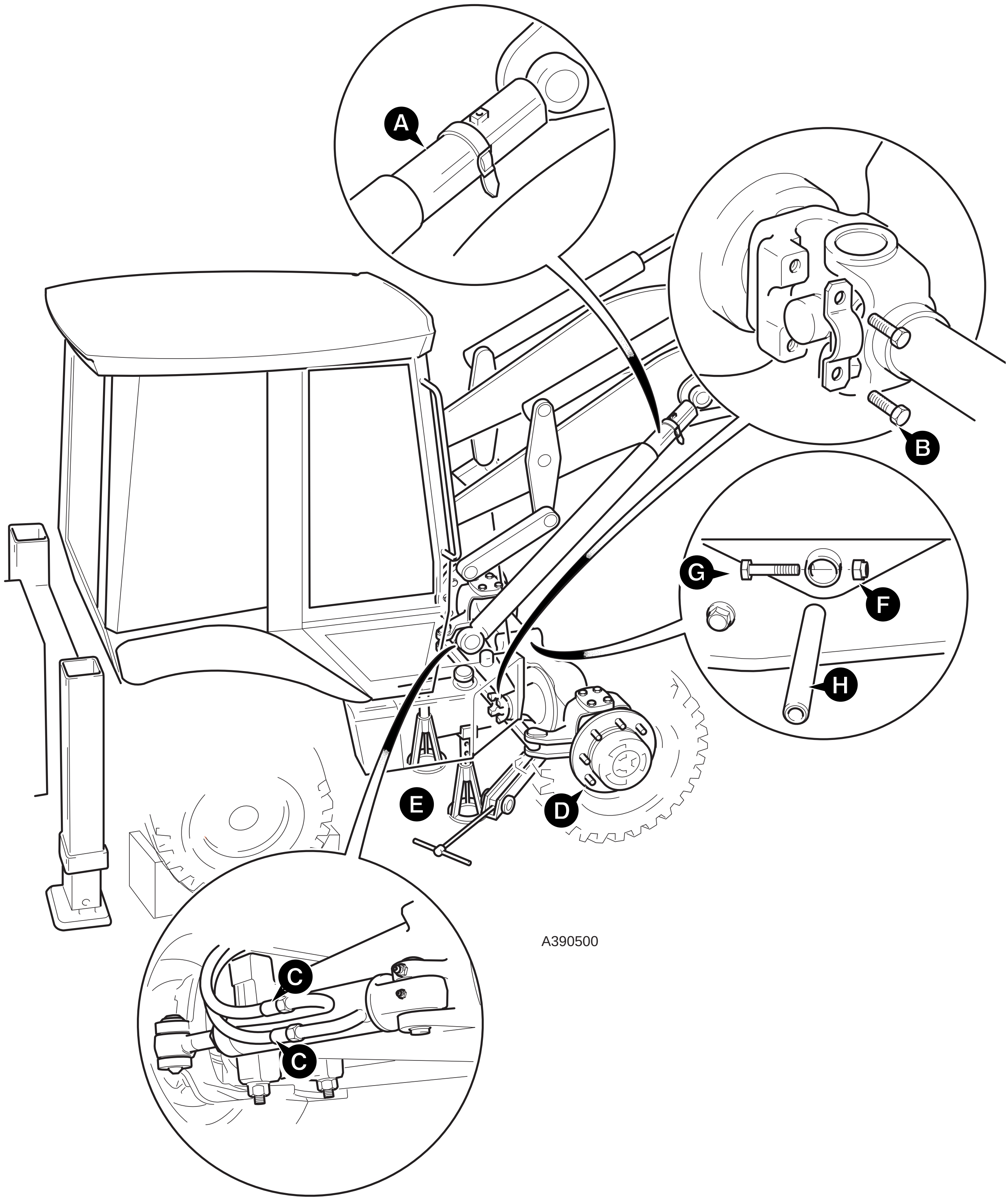
The propshaft must have both ends exactly on the same plane as shown at **X**. The yokes must not be at right angles as at **Y** or at an intermediate angle as at **Z**.



Torque Settings

Item	Nm	kgf m	lbf ft
1	21	2.1	15
2	40 - 48	4.08 - 4.90	29.5 - 35.4




A
B
G
F
H
E
D
C
C
A390500

Removal and Replacement

⚠ WARNING

A raised and badly supported machine can fall on you. Position the machine on a firm, level surface before raising one end. Ensure the other end is securely chocked. Do not rely solely on the machine hydraulics or jacks to support the machine when working under it.

Disconnect the battery, to prevent the engine being started while you are beneath the machine.
GEN 1- 1

Removal

⚠ WARNING

Raised loader arms can drop suddenly and cause serious injury. Before working under raised loader arms, fit the loader arm safety strut.
GEN3-2

1 Raise the loader arms and engage the parking brake. Install the safety strut **A** and block the rear wheels.

2 Using service tool 892/00822 remove bolts **B** to disconnect the propshaft from the axle, refer to **Propshafts - Removing and Replacing**.

3 Disconnect the hydraulic hoses **C** from the steer ram and blank off all exposed connections.

4 Loosen the road wheel retaining nuts **D**.

5 Prop the machine on each side as shown at **E**.

6 Remove the front road wheels.

7 Position a jack underneath the balance point (see **Note**) of the axle and support the axle weight.

Note: Because the drivehead assembly is offset, the balance point of the axle is not the centre of the axle. Attach a 'cradle' to the jack that will partially embrace the axle.

8 Remove nut **F** and pivot pin retaining bolt **G**.

9 Use puller, service tool 992/00800 to remove the pivot pin **H**.

10 Lower the jack so that the axle is clear of the mounting yoke and remove the axle.

Replacement

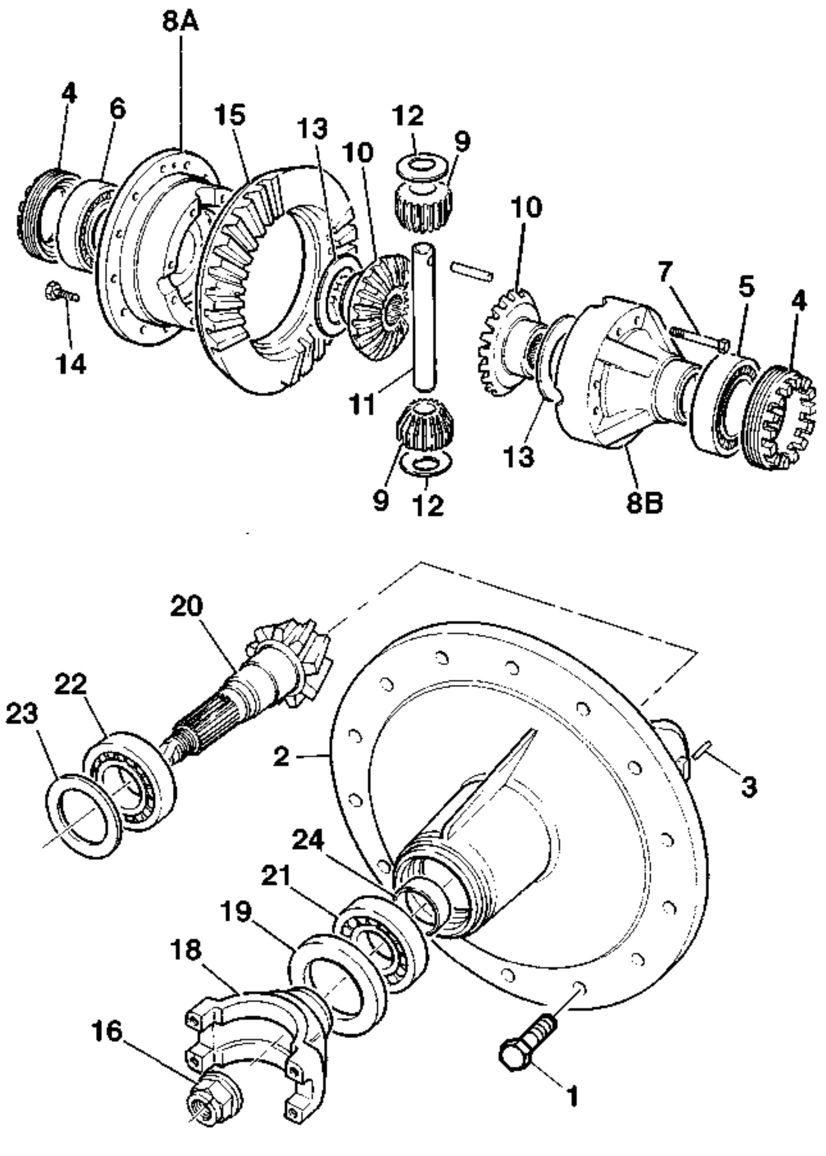
1 Replacing is the reverse of the removal sequence.

2 Apply JCB Threadlocker & Sealer to the threads of bolts **B**.

Torque Settings

Item	Nm	kgf m	lbf ft
B	40-48	4.08-4.90	29.5-35.4
D	680	69	500

Drive Head Maxtrac - Dismantling



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Drive Head Maxtrac - Dismantling

The numerical sequence shown on the illustration is intended as a guide to dismantling.

1 Drain the oil from the drive head. Remove the propshaft, refer to **Propshafts - Removing and Replacing**.

2 To remove the drive head it is necessary to withdraw both drive shafts from the axle, refer to **Axle Hub and Driveshafts - Dismantling and Assembly**.

3 Remove the drive head carrier screws **1**. Mark the installed position of drive head carrier **2** relative to the axle housing.

4 Remove the drive head carrier **2** from the axle housing and remove the old sealant from the mating faces.

5 Pull out the roll pins **3** and remove the castellated nuts **4**. Remove the outer races of bearings **5** and **6** from the drive head carrier bores.

6 Remove inner bearing races of **5** and **6**.

7 Remove differential assembly **8** from carrier.

8 Loosen the differential case half bolts **7** and pull the case halves **8A** and **8B** apart. Remove the axle bevel gears **9**, the differential bevel gears **10**, trunnion pin **11** and thrust washers **12** from the case halves.

9 Remove the thrust washers **13** from both case halves.

10 Pull off the bearing **6** from case half **8A**.

11 Remove the Verbus Ripp bolts **14** and separate the crownwheel **15** from the case half **8A**.

12 Remove pinion nut **16**. Use Service Tool 892/00812 to prevent drive yoke **18** from rotating.

13 Mark the position of the drive yoke on the splined shaft. Remove the drive yoke.

14 Drive pinion shaft **20** out of drive head carrier **2**.

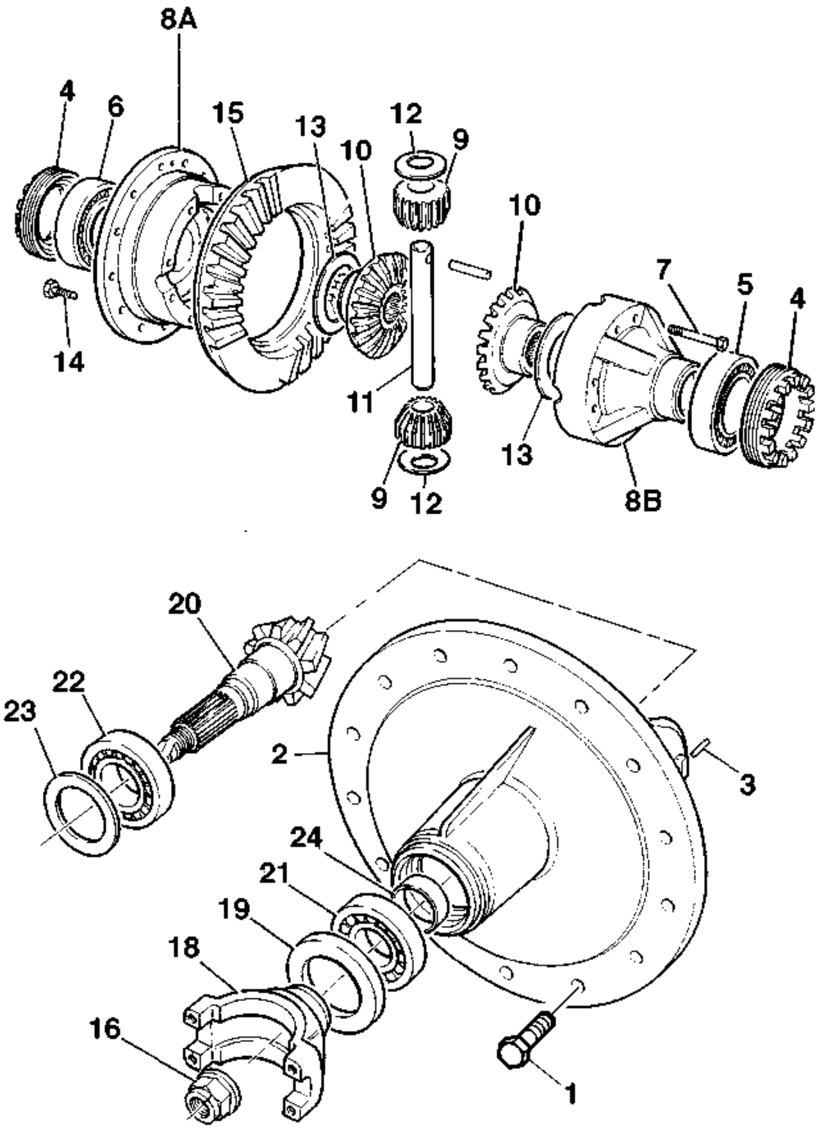
15 Prise shaft seal **19** out of the bore.

16 Remove taper roller bearing **21** and tap out the outer bearing race.

17 Tap out the outer race of bearing **22** from the opposite bearing housing and remove the drive pinion shim(s) **23**.

18 Remove spacer **24** from drive pinion **20**. Prise taper roller bearing **22** to raise it sufficiently to insert bearing pullers. Pull the bearing from the pinion shaft.

Drive Head Maxtrac - Assembly



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Drive Head Maxtrac - Assembly

The outline procedure below refers also to the following aspects of the drivehead assembly, which are covered separately in detail as sub topics later in this section:

Pinion Depth Setting
Collapsible Spacer Assembly
Crown Wheel and Pinion Meshing

Note: Both the crownwheel **15** and pinion **20** and the bevel gears **9** and **10** are matched and should be renewed as sets if any of their components are damaged or excessively worn. The two differential housing halves **8A** and **8B** are also matched. Do not use unmatched halves.

Make sure all bearings are lightly oiled before fitting and setting. Make sure bearings are rotated whilst being set.

1 Determine the correct thickness required for the shims **23**, refer to **Pinion Depth Setting**.

2 Fit shims **23** behind new bearing cup **22**.

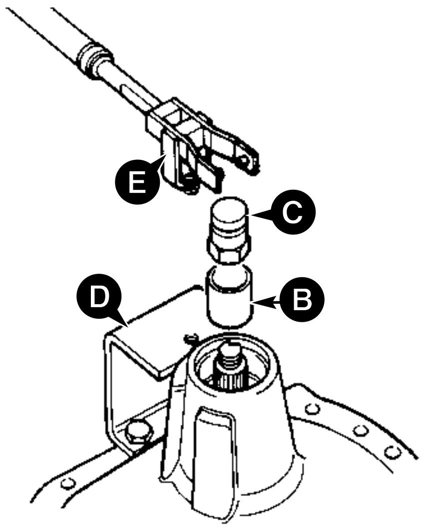
3 Fit new pinion head bearing cone **22** onto pinion **20**.

4 Install pinion and bearings into the drive head casing. Install largest available solid spacer **24** e.g (14.20 mm) and fit pinion tail bearing **21** (lightly oiled). Do not fit the oil seal **19** at this stage.

Note: In the absence of the special tools required or the correct size solid spacer **24** it is acceptable to fit a collapsible spacer, refer to **Collapsible Spacer Assembly**.

5 Fit special tool sleeve **B** and special pinion shaft adapter **C**. Tighten adapter **C** to approximately 50 Nm, making sure the pinion is free to rotate and there is end float, this will prevent any damage to the bearing. If the pinion is not free to rotate or there is no end float at this stage check the bearing is fitted correctly. Also check the correct size spacer has been fitted.

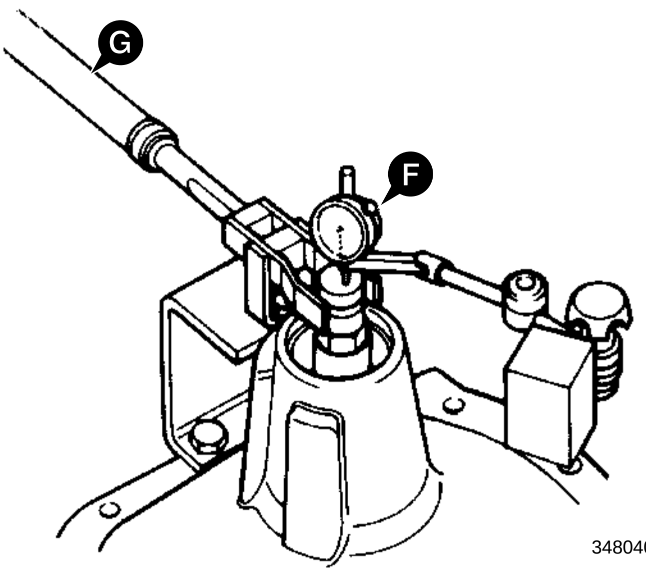
6 Fit special bracket **D** to the drive-head housing using two M10 x 30 nuts and bolts. Fit special tool support pillar **E** to bracket **D** so that the fork end engages in adapter **C**. Ensure that fork **E** is centrally located on adapter **C**. If necessary, re-align bracket **D** to suit.



348030

7 Fit dial test indicator (DTI) **F**. Ensure that the DTI is mounted on the drive head and not on bracket **D**.

8 Set torque wrench **G** to 35 Nm (25.8 lbf ft) and measure the end float while rotating the shaft.



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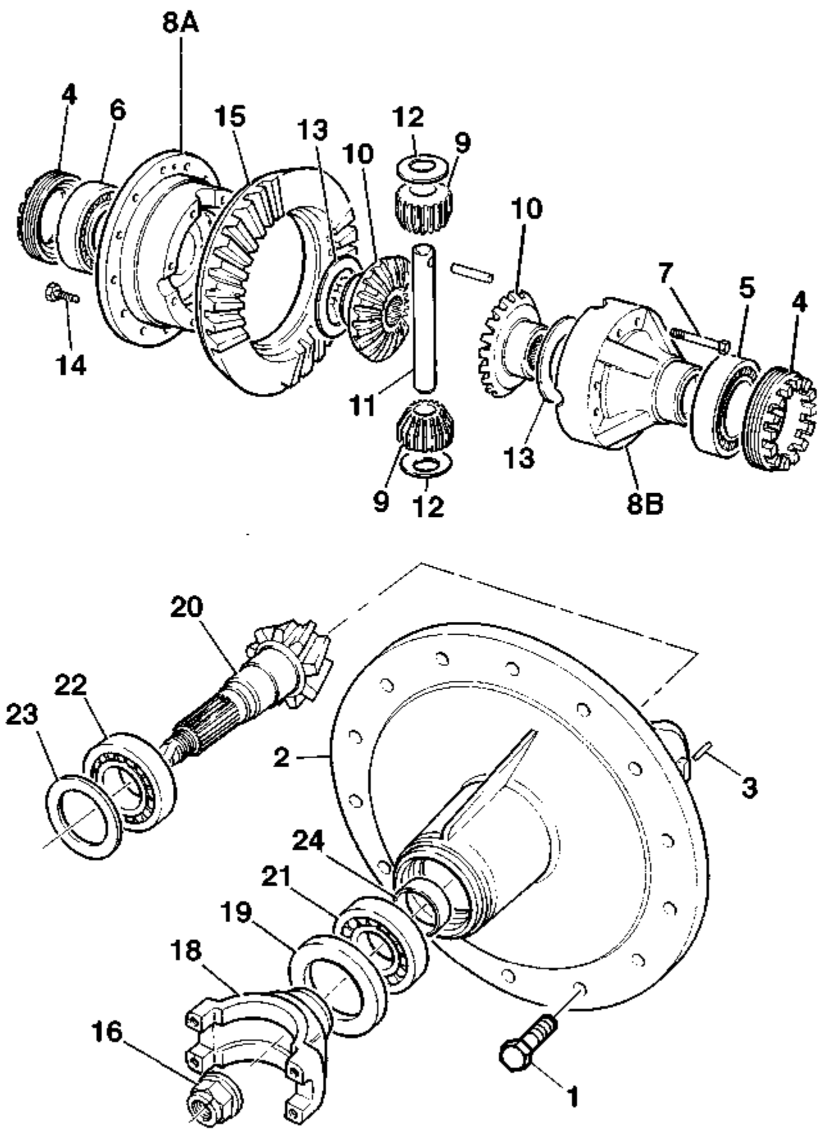
Drive Head Maxtrac - Assembly (cont'd)



S385640

Drive Head Maxtrac - Assembly (cont'd)

9 To select the right size spacer **24**, subtract the end float obtained at step 7 from the solid spacer size (14.20 mm). Also subtract 0.04 mm to allow for theoretical bearing tolerance and pre load. The result is the size of spacer to be fitted from the solid spacer setting kit. If there is no spacer of this size, fit the next nearest size spacer, refer to **Service Tools - Axles**.

Example

Temporary spacer size	14.20
Subtract end-float	0.25
Total	13.95
Subtract tolerance & preload	0.04
Result	**13.91**

(No spacer available this size, use next nearest size spacer i.e 13.900)

10 Remove sleeve **B** and temporary spacer. fit correct size spacer from solid spacer setting kit, refer to **Service Tools - Axles**. During removal take care to avoid damaging the outer bearing.

11 Fit sleeve **B.** Tighten adapter **C** to no more than 50 Nm to protect against bearing damage while spacer selection is verified making sure the pinion is free to rotate. Check there is no end float and pinion is free to turn smoothly by hand. Remove adapter **C** and fit nut **16.** Then check that rolling torque is less than 2.0 Nm. If the rolling torque exceeds 2.0 Nm, check that the shaft has been assembled correctly.

Note: If the pinion is not free to rotate check the correct size spacer has been fitted.

12 If rolling torque measured at step 10 is too high, fit the next larger size spacer. If rolling torque is too low, fit the next smallest size spacer. If a correct spacer is not available from the range, check that drive head is assembled correctly.

13 Remove adapter **C** and sleeve **B**. Fit new oil seal **19**, grease between seal lips before fitting. Fit coupling yoke **18** and NEW stake nut **16**.

14 Progressively torque tighten stake nut **16**, occasionally rotating coupling yoke, up to 250 Nm. Providing the correct size spacer has been selected the rolling torque should be between 2.3 and 3.4 Nm including seal drag.

Note: The nut tightening torque can be increased to a maximum of 300 Nm provided that the pinion rolling torque does not exceed the maximum of 3.4 Nm.

15 Finally stake the nut **16** into the slot.

16 Assemble the trunnion pin **11**, bevel gears **9** and **10** and their thrust washers **12** and **13** into differential half case **8A**.

17 Position differential half case **8B** onto half case **8A**, aligning the match-mark letters. Apply JCB Threadlocker and Sealer to the threads of bolts **7**, then fit and torque tighten to 46 Nm (34 lbf ft, 4.7 kgf m). Check the gears for free rotation.

18 Fit crownwheel **15** using new Verbus Ripp bolts **14** tightened to 94 Nm (69 lbf ft, 9.59 kgf m).

19 Locate crownwheel assembly (without bearings) into housing.

20 Drive bearing cones **5** and **6** onto differential case spigots. Lightly oil the bearings then fit their bearing cups and castellated nuts **4** into drive head carrier **2**. Do not fit the roll pins **3** at this stage.

21 Adjust castellated nuts **4** to give an increase in input pinion rolling torque of between 1.36 - 2.5 Nm (12 - 22 lbf in) more than that recorded in Step 13.

22 Measure the backlash between crownwheel **15** and pinion **20**, which should be 0.17 - 0.28 mm (0.006 - 0.010 in). Adjust castellated nuts **4** by equal amounts when altering backlash. When backlash and preload are both correct, fit roll pins **3**.

23 Check tooth marking to verify crownwheel and pinion are set correctly, refer to **Crownwheel and Pinion Meshing**.

24 Apply JCB Multigasket to the mating faces of drive head carrier **2** and the axle casing. Fit the drive head carrier to the axle casing with the crownwheel towards the short drive shaft. Fit securing bolts **1** and tighten to 98 Nm (72 lbf ft, 10 kgf m).

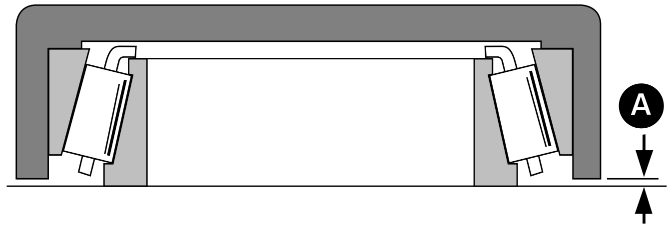
25 Reassemble both driveshafts and hub assemblies, refer to **Axle Hub and Driveshaft - Dismantling and Assembly**.

26 Re-fill the hubs and differential with the correct grade of oil, refer to Section 3 **Lubricants and Capacities**.

27 Refit the propshaft, refer to **Propshafts - Removing and Replacing**.

Pinion Depth Setting

1 Place new pinion head bearing assembly on a flat surface and position service tool 892/00174 over the bearing. Measure gap **A** (e.g. 0.20 mm) and add this to the cup depth stamped on the tool (e.g. 30.01 mm) to obtain the bearing depth.



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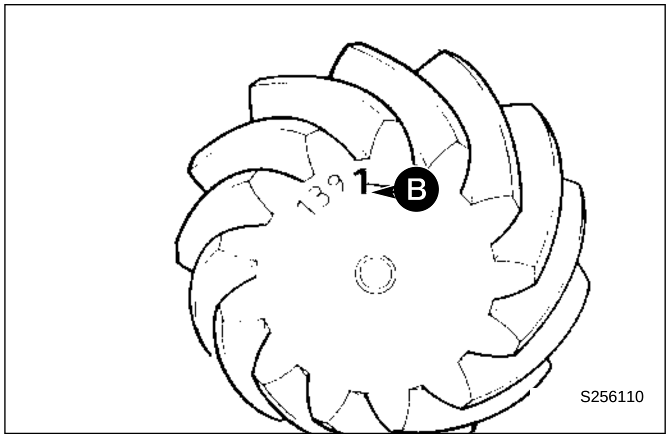
2 From the face of the pinion, obtain the etched deviation figure **B** (e.g. + 2) which is in units of 0.01 mm. If positive, add this to the bearing depth; if negative, subtract from the bearing depth.

3 Obtain the deviation figure **C** (e.g. - 1) stamped on the differential housing bolt flange. If negative, add to bearing depth; if positive, subtract from bearing depth.



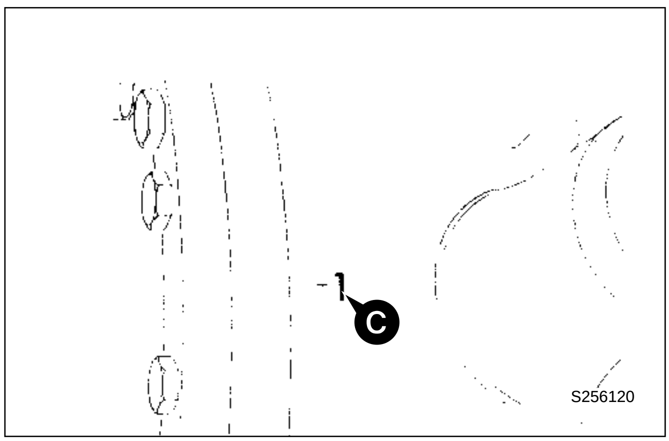
S256110

4 Subtract the total of the above figures from the standard value of 31.19 mm. The result will be the thickness of shims required behind the pinion head bearing cup.

Example (all dimensions in millimetres)

Cup depth	30.01
Gap **A**	+0.20
Bearing depth	30.21
Pinion deviation **B** (+ 2)	+0.02
Housing deviation **C** (- 1)	+0.01
Total	30.24

Standard value	31.19
Less Total above	30.24
Shim Thickness	0.95



S256120

Note: In the event that the setting data stamp has been ommited from the drivehead casing, adopt the following setting procedure:

Revise the shim pack size by the difference in setting height marked on the old and new crownwheel pinion sets.

Collapsible Spacer Assembly

When assembling the axle, if the special tools listed in the **Service Tools - Axles** section or if the correct size solid spacer is not available it is acceptable to fit a collapsible spacer using the procedure below.

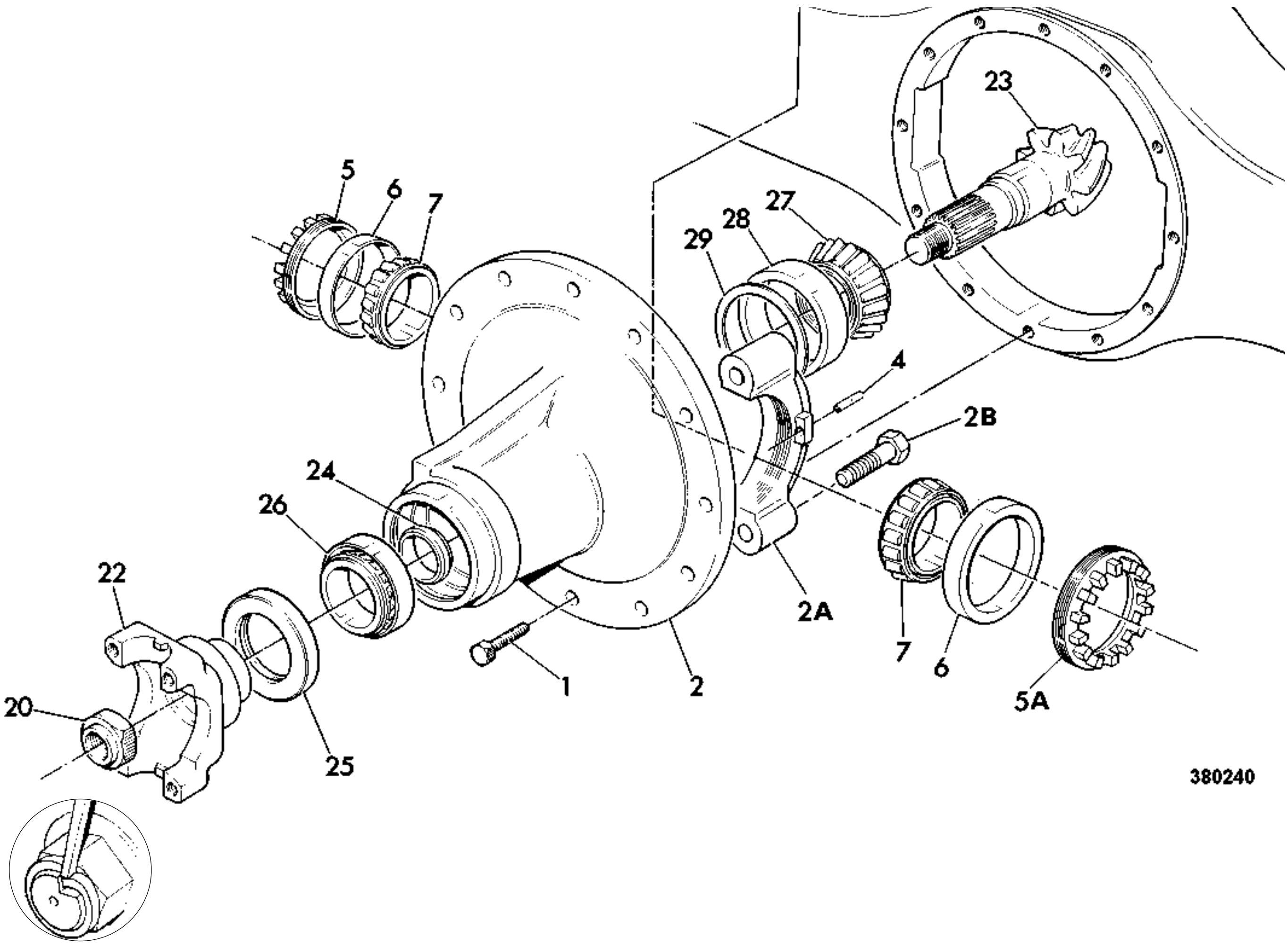
1 Smear output shaft inner bearing **27** with JCB HP Grease before refitting. Fit bearing cup **28** over pinion shaft **23** and assemble into drive head casing.

2 Fit NEW collapsible spacer **24**, after smearing with JCB HP Grease fit outer bearing **26** followed by a new oil seal **25**. Grease between seal lips before fitting. Assemble yoke **22** and NEW stake nut **20** with integral washer.

3 Tighten stake nut to achieve a rolling torque of 1.5 to 2.8 Nm (1.1 to 21. lbf ft), inclusive of seal drag.

Note: If this figure is accidentally exceeded the output shaft must be dismantled and the collapsible spacer **24** renewed.

4 Finally stake nut into slot.



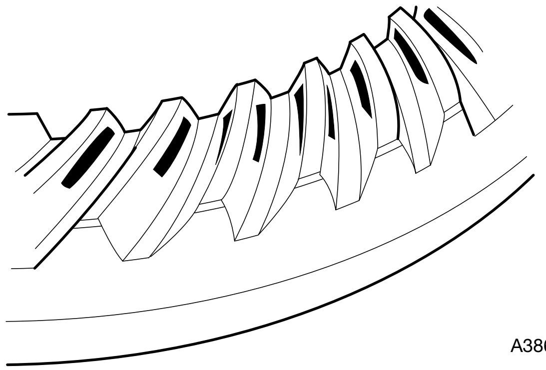
S235760

Crownwheel and Pinion Meshing

Meshing of the gears should be checked by marking three of the pinion teeth with engineers marking compound and rotating the pinion.

The marking will then be transferred to the crown wheel teeth.

Correct tooth marking.



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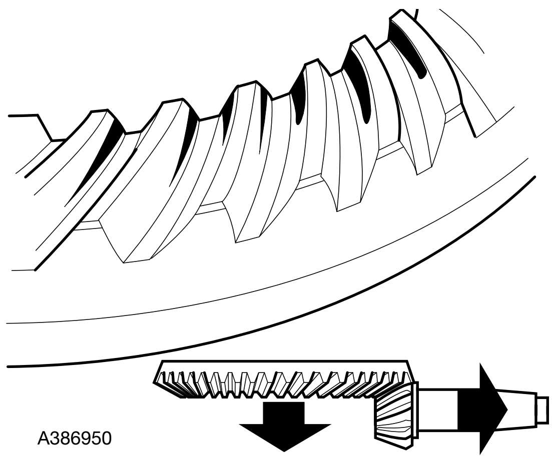
Pinion too deeply in mesh.

Decrease the shim thickness between the pinion inner bearing cup and the axle casing. Move the crown wheel towards the pinion to correct the backlash.



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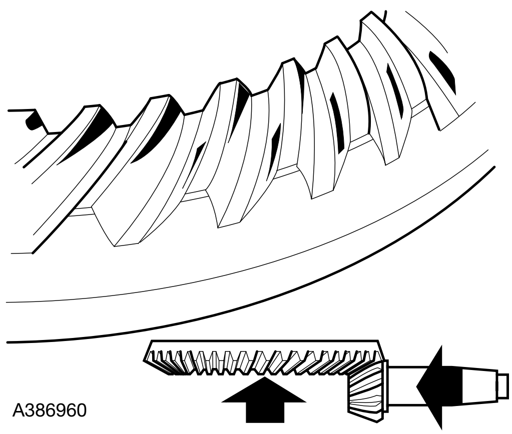
Pinion too far out of mesh.

Increase the shim thickness between the pinion inner bearing cup and the axle casing. Move the crown wheel away from the pinion to correct the backlash.



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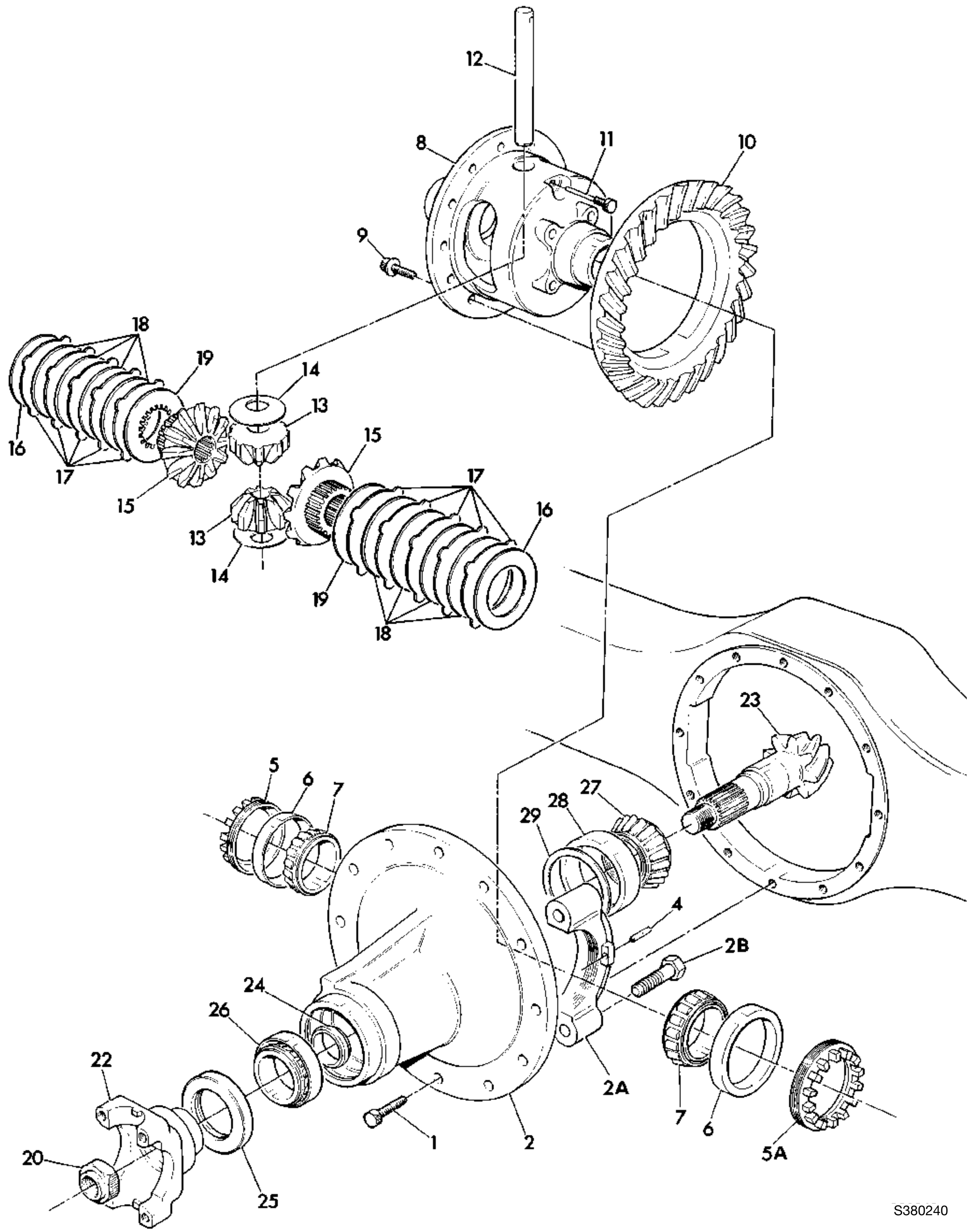
Drive Head Limited Slip Differential - Dismantling



Drive Head Limited Slip Differential - Dismantling

The numerical sequence shown on the illustration is intended as a guide to dismantling.

For assembly the sequence should be reversed.

⚠ WARNING

A raised and badly supported machine can fall on you. Position the machine on a firm, level surface before raising one end. Ensure the other end is securely chocked. Do not rely solely on the machine hydraulics or jacks to support the machine when working under it.

Disconnect the battery, to prevent the engine being started while you are beneath the machine.

GEN-1-1

1 Drain the oil from the drive head. Remove the propshaft, refer to **Propshafts - Removing and Replacing**.

2 To remove the drive head it is necessary to withdraw both drive shafts from the axle, refer to **Axle Hub and Driveshafts - Dismantling and Assembly**.

3 Remove securing bolts **1**. Mark the installed position of the drivehead carrier **2** relative to the axle housing. Remove the drivehead carrier **2** from the axle housing and remove the old sealant from the mating faces.

4 Pull out roll pins **4** and unscrew castellated nuts **5** and **5A**. Remove bearing cups **6**.

5 Identify the manufacturer's marks on the drive head casing **2** and the bearing caps **2A** for subsequent assembly. Remove bolts **2B** and remove the differential assembly **8** from the drivehead. Remove bearings **7**.

6 Using Service Tool 892/00812, remove drive yoke **22** and drive out pinion **23** complete with spacer **24.** Remove oil seal **25** and pinion tail bearing **26**. Drive pinion head bearing cone **27** from the pinion.

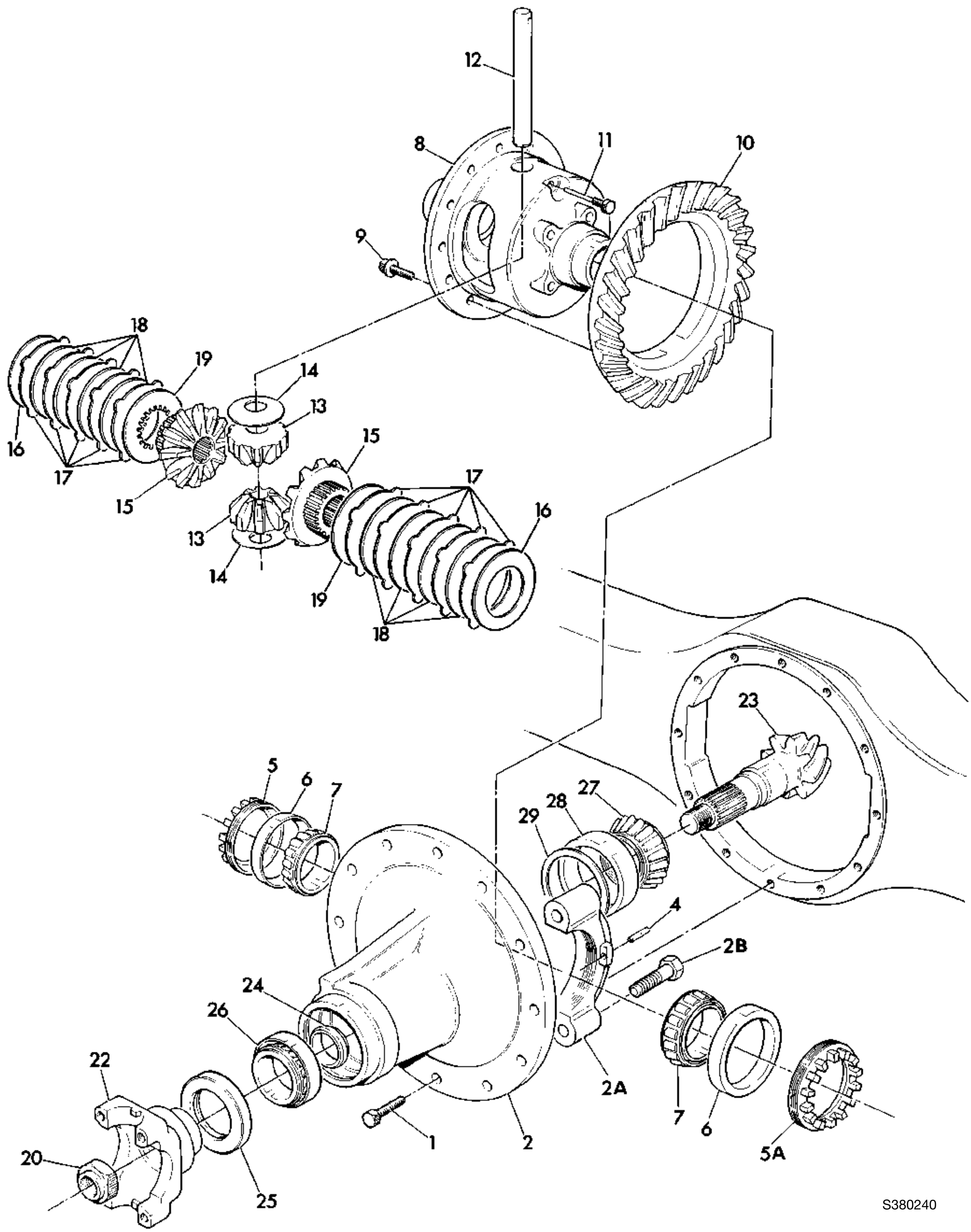
7 Remove pinion head bearing cup **28** with its shims **29**.

8 Unscrew Verbus Ripp bolts **9** using heavy duty socket 892/00819 and remove crownwheel **10**.

9 Remove bolt **11** and drive out trunnion pin **12**.

10 Rotate side gears **15** to eject planet gears **13** and thrust washers **14.** Lift out side gears, pressure plates **19**, counter plates **17**, friction plates **18** and shims **16**.

Drive Head Limited Slip Differential - Assembly



Drive Head Limited Slip Differential - Assembly

The outline procedure below refers also to the following aspects of the drivehead assembly, which are covered separately in detail as sub topics later in this section:

Pinion Depth Setting
Collapsible Spacer Assembly
Crown Wheel and Pinion Meshing

Both the crownwheel **10** and pinion **23**, and the side gears **15** and planet gears **13** are matched and should be renewed as sets if any of their components are damaged or excessively worn.

Make sure all bearings are lightly oiled before fitting and setting. Make sure bearings are rotated whilst being set.

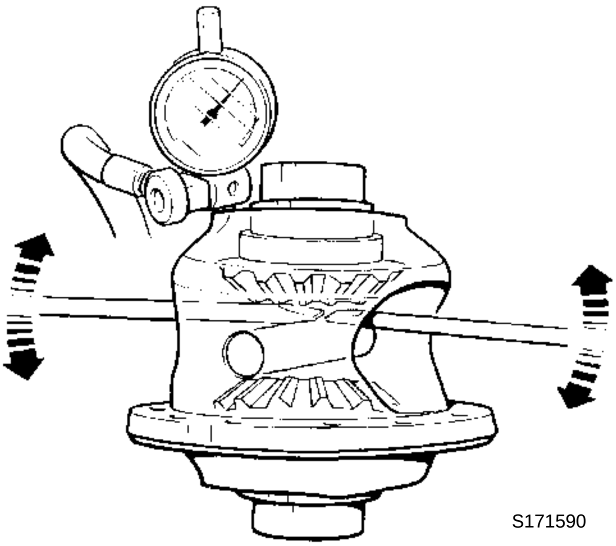
1 Fit side gears **15**, with pressure plates **19**, counter plates **17** and friction plates **18** into differential case **8**.

Note: Do not fit the shims **16** at this point.

Position planet gears **13** and thrust washers **14** until they are engaged with side gears and diametrically opposed. Rotate side gears until planet gears and washers align with trunnion pin bore.

2 Drive in trunnion pin **12** until bolt **11** can be located.

3 Using a dial test indicator, with two screwdrivers or suitable levers, gently apply pressure to side gear **15** away from the trunnion pins **12** as shown. Measure and note the end-float of the side gear.



S171590

4 Turn the differential assembly over and repeat step **3** for the second side gear.

5 Dismantle the differential assembly. Add shims **16** to give end-float between 0.1 and 0.2mm (0.004 and 0.008in.).

Note: Shimming must be carried out whenever the differential is dismantled, however the end float 0.1 and 0.2 mm (0.004 and 0.008 in.) can be exceeded on previously assembled differential as this is only an initial setting figure which allows for bedding in.

6 Repeat steps **2**, **3**, and **4**. If the end float is correct. Remove bolt **11** apply JCB Threadlock and Sealer to threads of bolt then fit and tighten to 28 Nm (20 lbf ft).

7 Fit crownwheel **10** using new Verbus Ripp bolts **9** tightened to 94 Nm (70 lbf ft).

8 Determine the correct thickness required for the shim **29**, refer to **Pinion Depth Setting**.

9 Fit shims **29** behind new bearing cup **28**.

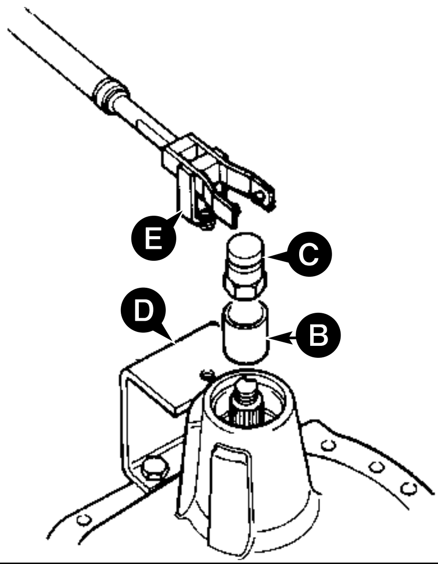
10 Press new pinion head bearing cone **27** onto pinion **23** using press 892/00179 with adapters 992/07608 and 992/07609.

11 Install pinion and bearings into the drive head casing. Install largest available solid spacer **24** e.g (14.20 mm) and fit pinion tail bearing **26** (lightly oiled). Do not fit the oil seal **25** at this stage.

Note: In the absence of the special tools required or the correct size solid spacer **24** it is acceptable to fit a collapsible spacer, refer to **Collapsible Spacer Assembly**.

12 Fit special tool sleeve **B** and special pinion shaft adapter **C**. Tighten adapter **C** to approximately 50 Nm, making sure the pinion is free to rotate and there is end float, this will prevent any damage to the bearing. If the pinion is not free to rotate or there is no end float at this stage check the bearing is fitted correctly. Also check the correct size spacer has been fitted.

13 Fit special bracket **D** to the drive-head housing using two M10 x 30 nuts and bolts. Fit special tool support pillar **E** to bracket **D** so that the fork end engages in adapter **C**. Ensure that fork **E** is centrally located on adapter **C**. If necessary, re-align bracket **D** to suit.



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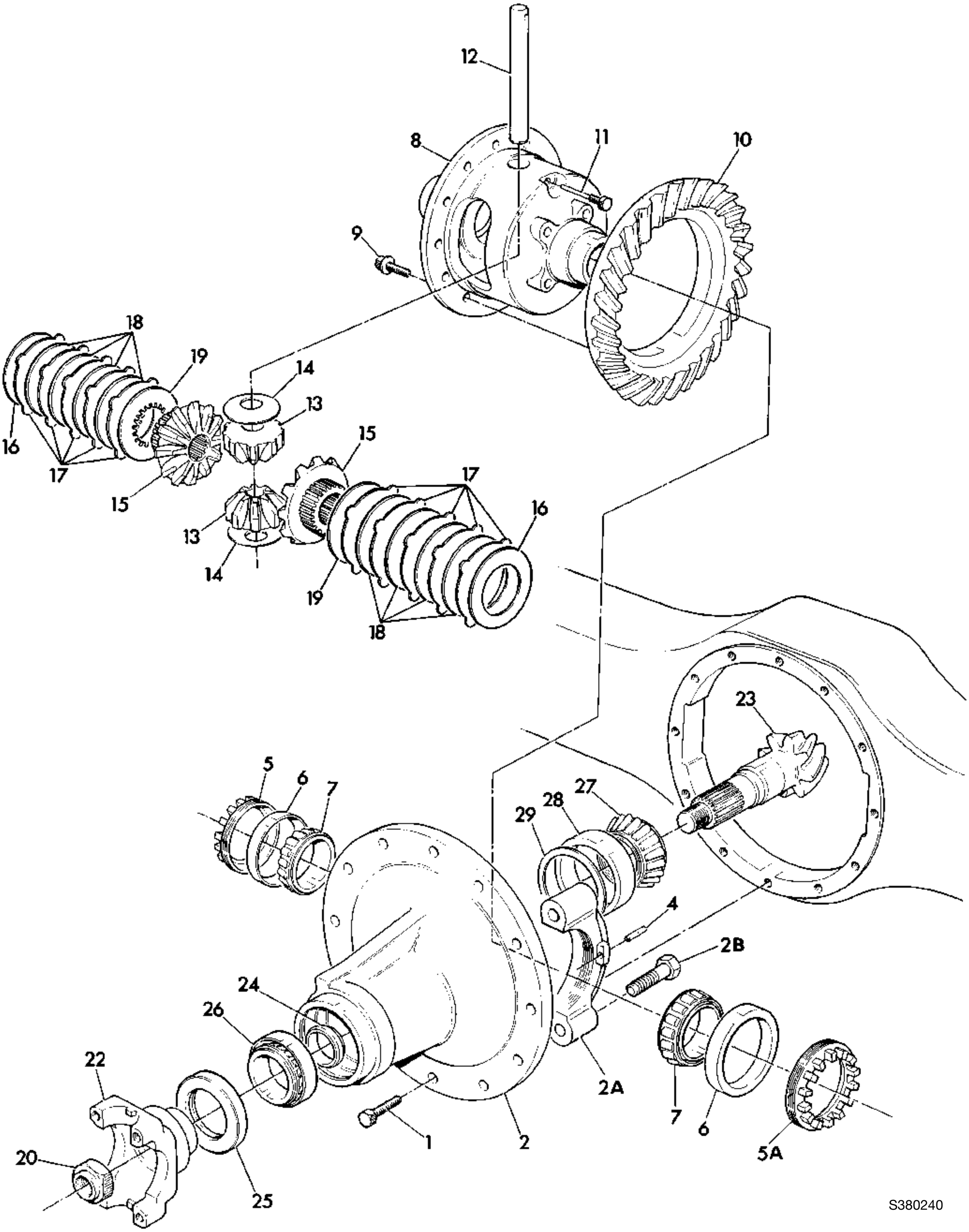
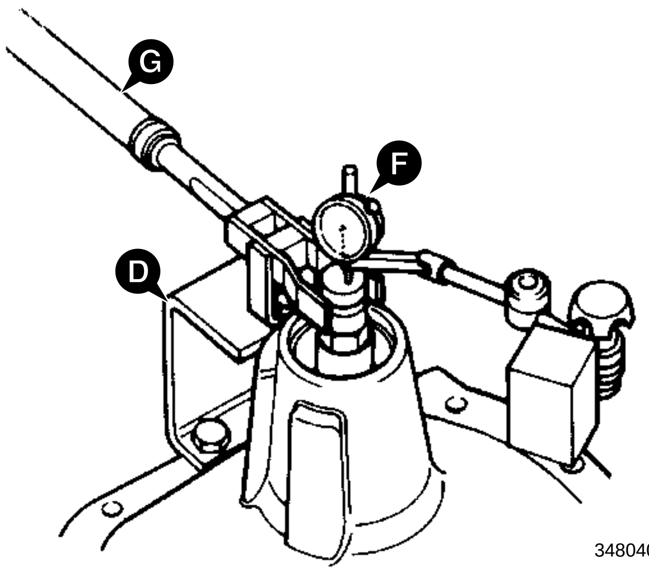
Drive Head Limited Slip Differential - Assembly



Drive Head Limited Slip Differential - Assembly (cont'd)

14 Fit dial test indicator (DTI) **F**. Ensure that the DTI is mounted on the drive head and not on bracket **D**.

15 Set torque wrench **G** to 35 Nm (25.8 lbf ft) and measure the end float while rotating the shaft.



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16 To select the right size spacer **24**, subtract the end float obtained at step 7 from the solid spacer size (14.20 mm). Also subtract 0.04 mm to allow for theoretical bearing tolerance and pre load. The result is the size of spacer to be fitted from the solid spacer setting kit. If there is no spacer of this size, fit the next nearest size spacer, refer to **Service Tools - Axles**.

Example

Temporary spacer size	14.20
Subtract end-float	0.25
Total	13.95
Subtract tolerance & preload	0.04
Result	**13.91**

(No spacer available this size, use next nearest size spacer i.e 13.900)

17 Remove sleeve **B** and temporary spacer, fit correct size spacer from solid spacer setting kit, refer to **Service Tools - Axles**. During removal take care to avoid damaging the outer bearing.

18 Fit sleeve **B.** Tighten adapter **C** to no more than 50 Nm to protect against bearing damage while spacer selection is verified making sure the pinion is free to rotate. Check there is no end float and pinion is free to turn smoothly by hand. Remove adapter **C** and fit nut **16.** Then check that rolling torque is less than 2.0 Nm. If the rolling torque exceeds 2.0 Nm, check that the shaft has been assembled correctly.

If the pinion is not free to rotate check the correct size spacer has been fitted.

19 If rolling torque measured at step 10 is too high, fit the next larger size spacer. If rolling torque is too low, fit the next smallest size spacer. If a correct spacer is not available from the range, check that drive head is assembled correctly.

20 Remove adapter **C** and sleeve **B**. Fit new oil seal **25**, grease between seal lips before fitting. Fit coupling yoke **22** and NEW stake nut **20**.

21 Progressively torque tighten stake nut **20**, occasionally rotating coupling yoke, up to 250 Nm. Providing the correct size spacer has been selected the rolling torque should be between 2.3 and 3.4 Nm including seal drag.

Note: The nut tightening torque can be increased to a maximum of 300 Nm provided that the pinion rolling torque does not exceed the maximum of 3.4 Nm.

22 Finally stake the nut **20** into the slot.

23 Fit bearing caps **2A** using bolts **2B** tightened to 165 Nm (121 lbf ft). Make sure the manufacturer's marks are correctly aligned.

Note: Drivehead casing **2** and bearing caps **2A** are matched and should be renewed as a complete assembly if damaged or worn.

24 Locate differential assembly (without bearings) into drivehead.

Drive Head Limited Slip Differential - Assembly (cont'd)

25 Drive bearing cones **7** onto spigots, lightly oil the bearings then fit bearing cups **6** and castellated nuts **5.** Do not fit the roll pins **4** at this stage.

26 Adjust castellated nut **5** on crownwheel side until backlash is 0.17 mm - 0.28 mm (0.006 in - 0.010 in).

27 Adjust castellated nut **5A** until there is no end-float and no pre-load, ensuring that bearings are bedded in by rotating in each direction. Tighten nut **5A** by a further 4 castellations to set pre-load, ensuring that correct backlash is maintained. Fit roll pins **4**.

28 Check tooth marking to verify crown and pinion are set correctly, refer to **Crownwheel and Pinion Meshing**.

29 Apply JCB Multigasket to the mating faces of the drive head carrier **2** and the axle casing. Fit securing bolts **1** and tighten to 98 Nm (72 lbf ft, 10 kgf m).

30 Reassemble both driveshafts and hub assemblies, refer to **Axle Hub and Driveshaft - Dismantling and Assembly**.

31 Re-fill hubs and differential with the correct grade of oil, refer to Section 3 **Lubricants and Capacities**.

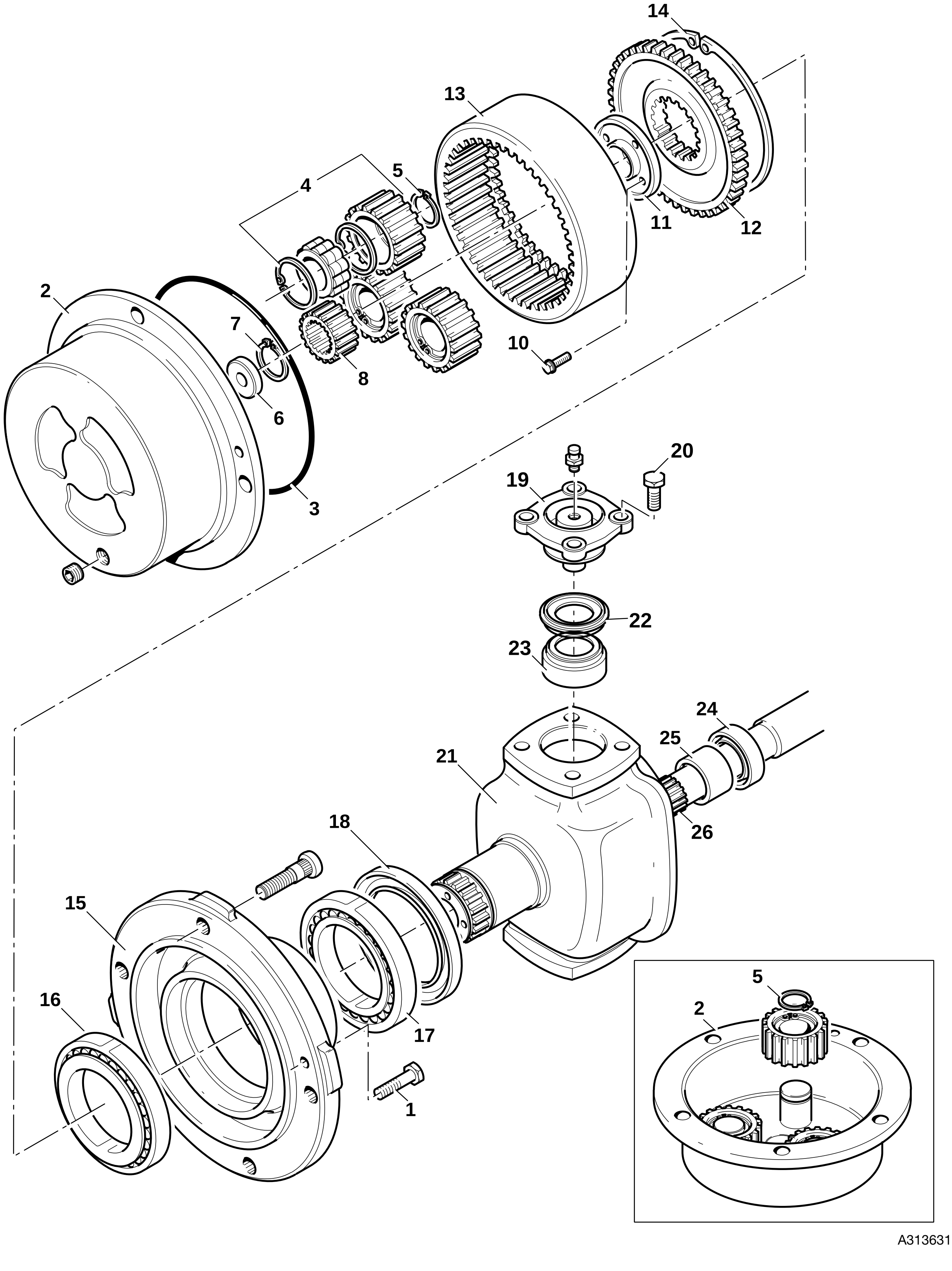
32 Refit the propshaft, refer to **Propshafts - Removing and Replacing**.

Friction Plate Wear Limits

Measure and note the thickness of the friction plate, the result must not be less than 1.25 mm (0.049 in).

Check the condition of the friction material, which should be even over both surfaces.

If in doubt, discard the set (friction and counter plates).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A313631

Axle Hub and Driveshaft - Dismantling

⚠ WARNING

A raised and badly supported machine can fall on you. Position the machine on a firm, level surface before raising one end. Ensure the other end is securely chocked. Do not rely solely on the machine hydraulics or jacks to support the machine when working under it.

Disconnect the battery, to prevent the engine being started while you are beneath the machine.
GEN 1-1

1 Disconnect the steer ram. Drain oil from hub.

2 Remove screws **1**.

3 Lever off the planet gear carrier **2** at the levering points. Remove and discard the 'O' ring **3**.

4 Remove planet gears **4** only if defective. Note that gears can only be removed as assemblies, which comprise the gear, the bearing and two 'L' shaped circlips. To remove a planet gear, first remove the external circlip **5**.

5 Pull off the planet gear assembly **4**.

6 The driveshaft thrust pad **6** is drilled and tapped M6 for removal purposes.

7 Remove circlip **7** to allow the sun gear **8** to be slid off the drive shaft.

8 Remove Verbus Rip bolts **10**. These bolts are very tight and care must be taken not to distort the bolt heads. Use as short an extension bar as possible with a six sided socket. Discard the bolts after removal.

Note: Fretting between the hub swivel and annulus carrier mating faces might be evident; this condition is normal, do not attempt to repair.

If the hub swivel and annulus carrier are to be renewed they must be renewed as a pair, not individually

9 Remove retaining plate **11**.

10 Mark the relationship between the annulus carrier, annulus ring and hub swivel, remove the annulus carrier **12** with annulus ring **13**.

11 Remove circlip **14** to separate the annulus ring **13** from the annulus carrier **12**.

12 Pull off the bearing carrier **15** together with the outer bearing **16**.

13 Pull off the inner bearing **17**.

14 Remove and discard combination oil seal **18**.

15 Mark the position of top and bottom trunnions **19**, undo bolts **20** and remove trunnions **19**. Withdraw the hub carrier **21**.

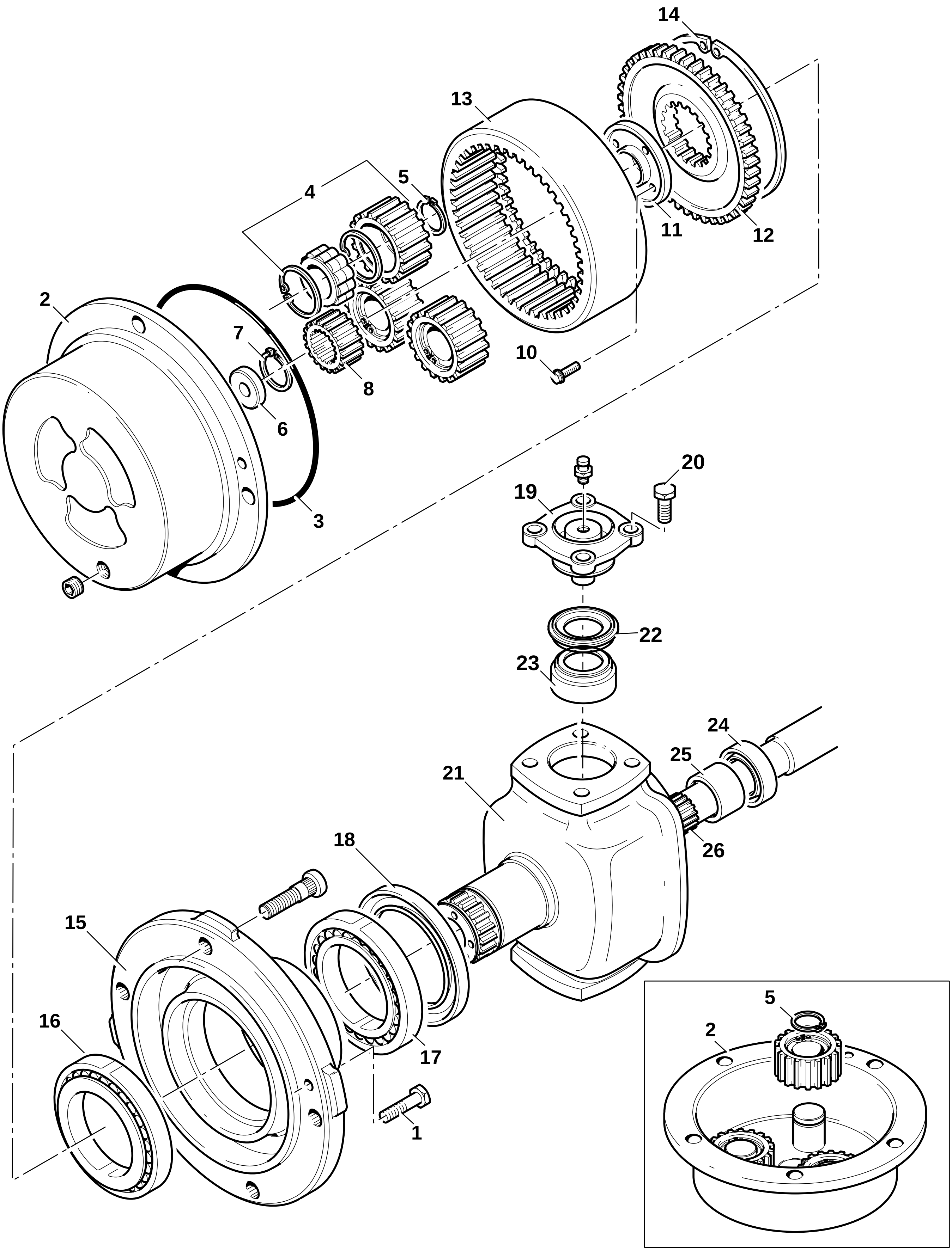
Note: Trunnions may be removed easily by pumping grease through the grease nipple.

16 Using a puller, remove the trunnion seal **22** and bearing **23**.

17 Remove seal **24** and needle roller bearing **25** from hub carrier **21**.

Note: Seal and needle roller bearing may be left on drive shaft. Production axles may be fitted with foam ‘masking rings’. These are used to protect the shaft from paint during axle spraying. The rings can be removed and discarded.

18 Withdraw drive shaft **26**.



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Axle Hub and Driveshaft - Assembly

1 Fit drive shaft **26** inner end into splines of differential gears.

2 Fit needle roller bearing **25** and seal **24** into hub carrier **21**. Pack grease between the lips of seal **24**.

Note: Do not force fit bearing **25** and make sure the manufacturer's mark is facing out.

3 Locate hub swivel, aligning relationship lines, assemble top and bottom trunnions **19** together with trunnion seal **22** and bearing **23**. Apply Threadlocker and Sealer to the threads of bolt **20**, torque tighten trunnion retaining bolts **20** to 98 Nm (72 lbf ft).

4 Lightly oil the inner wheel bearing race. Assemble the bearing cup and bearing race **17** into the bearing carrier **15.**

5 Fit a new combination seal **18** into the bearing carrier **15** so that the chamfer faces the hub swivel. Do not disassemble seal or use excessive force when fitting. Do not lubricate before fitting. Use service tool (892/00891) and spacer to drive the seal squarely into the carrier until flush.

6 Lightly oil the outer wheel bearing race. Assemble the bearing cup and bearing race **16** into the bearing carrier **15.** Fit bearing carrier assembly onto axle stub.

Note: The bearing carrier must be fully supported during the fitting operation; do not allow any weight to rest on the bearings, otherwise the inner bearing will be displaced and damage the seal.

7 Align relationship marks made on dismantling. Assemble the annulus ring **13** to the annulus carrier **12**. Secure with circlip **14**.

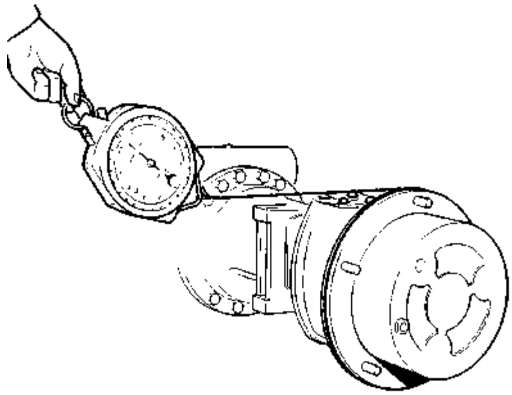
8 Fit annulus assembly in the same angular position as removal, fit retaining plate **11** using new bolts **10**. Do not fully tighten bolts but allow the bearing carrier to rock slightly.

Note: Steps 10 to 12 describe measurement of rolling force. To measure rolling torque (simplified process), a special tool is required. Refer to page 1/4-11.

9 Measure seal drag rolling force as follows:

a Refit the planet gear carrier **2** - DO NOT FIT THE SUN GEAR **8**.

b Use a spring balance and cord wrapped around planet gear carrier **2** as shown. Pull the spring balance so that the hub rotates, do several times to let the seal bed in and record the reading. Remove planet gear carrier **2.**



10 Torque tighten bolts **10** evenly to 166 Nm (122 lb ft, 17 kgf).

11 Measure the rolling force as follows:

a Refit the planet gear carrier **2** - DO NOT FIT THE SUN GEAR **8**. Use a spring balance and cord wrapped around the planet carrier as shown. Pull the spring balance so that the hub rotates and record the reading.

b To get the rolling force, subtract seal drag rolling force (see step **9**) from reading obtained at this step, the result should be 64 to 117N (14 to 26 lbf).

c If the resulting figure is outside these limits, check: the seal is fitted correctly; and/or renew bearings if necessary; and/or new fitted components. Remove planet gear carrier **2**.

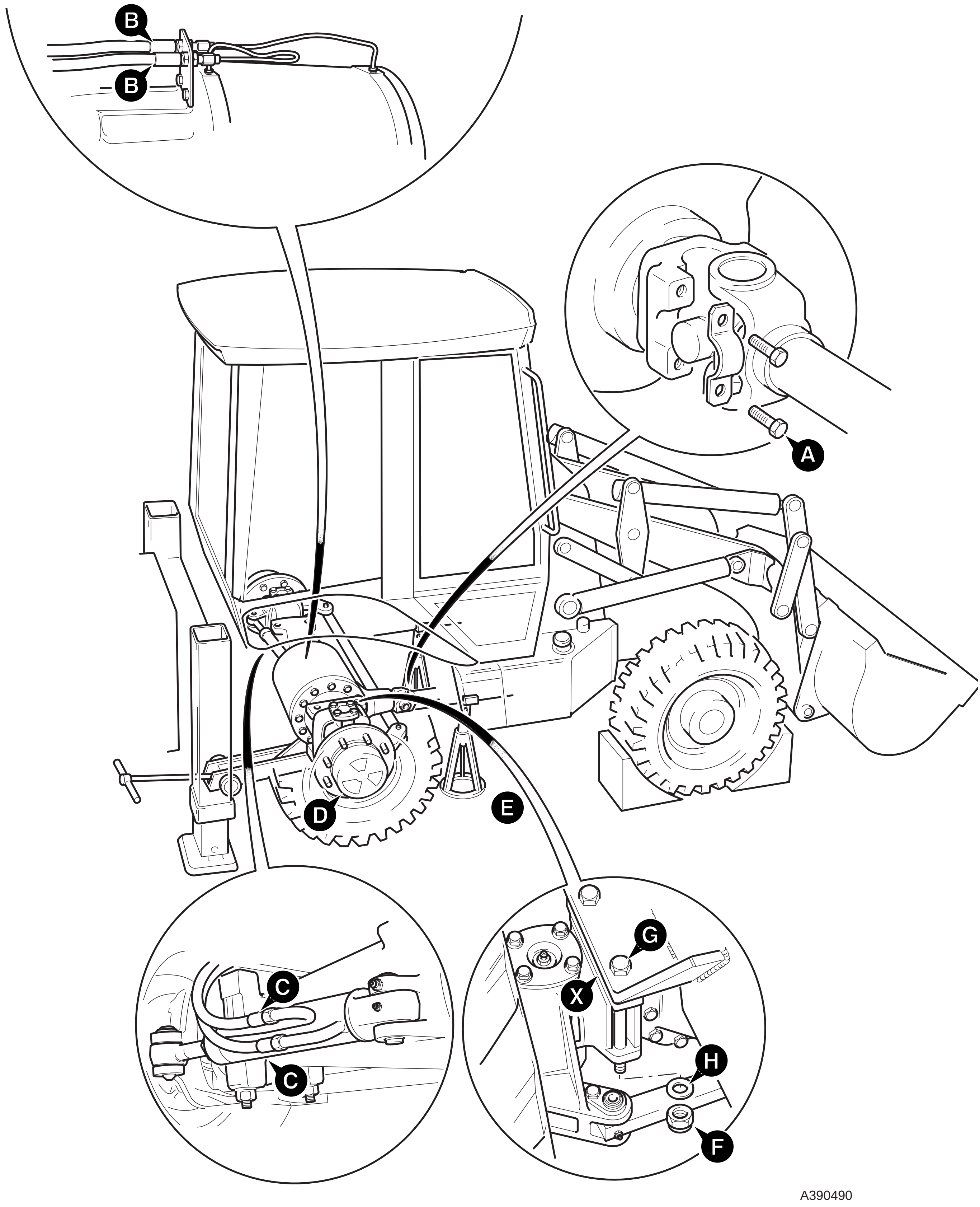
12 Press the drive shaft thrust pad **6** (chamfered side lowermost) into the recess in the planet carrier **2**.

13 Fit new planet gears **4** in place of any that were removed.

14 Slide the sun gear **8** (chamfer to be inboard) onto the drive shaft **26** and secure with circlip **7**. Fit a new 'O' ring **3** in place of the one discarded during dismantling.

15 Fit the planet carrier **2** onto the bearing carrier **15** ensuring that the two tapped holes are in line with those on the bearing carrier. Fit and tighten screws **1** after applying Threadlocker and Sealer to the threads. Torque tighten screws to 56 Nm (41 lb ft).

16 Fill hubs with correct grade oil.


B
B
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G
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A390490

Removal and Replacement

WARNING

A raised and badly supported machine can fall on you. Position the machine on a firm, level surface before raising one end. Ensure the other end is securely chocked. Do not rely solely on the machine hydraulics or jacks to support the machine when working under it.

Disconnect the battery, to prevent the engine being started while you are beneath the machine.
GEN 1-1

Removal

1 Engage the parking brake and block the front wheels. Use the stabiliser legs to raise the rear end of the machine.

2 Using service tool 892/00822 remove bolts **A** to disconnect the propshaft from the axle, refer to **Propshafts - Removing and Replacing**.

3 Disconnect the brake hydraulic hoses **B** from the axle centre casing and blank off the exposed connections.

4 Disconnect the hydraulic hoses **C** from the steer ram and blank off all exposed connections.

5 Loosen the road wheel retaining nuts **D**.

6 Prop the machine on each side as shown at **E**.

7 Remove the rear road wheels.

8 Position a jack underneath the balance point (see **Note**) of the axle and support the axle weight.

Note: Because the drivehead assembly is offset, the balance point of the axle is not the centre of the axle. Attach a 'cradle' to the jack that will partially embrace the axle.

9 Remove nuts **F**, bolts **G** and washers **H**.

10 Lower the jack and remove the axle.

Note: Some machines may be fitted with a packer (6mm thick) under the axle mounts on both sides, as shown at **X**.

Replacement

1 Replacing is the reverse of the removal sequence.

2 Apply JCB Threadlocker & Sealer to the threads of bolts **A**.

CAUTION

Bleed the brake system before driving the machine.
BRAK 1-6

Refer to Section G **Service Brakes - Bleeding**.

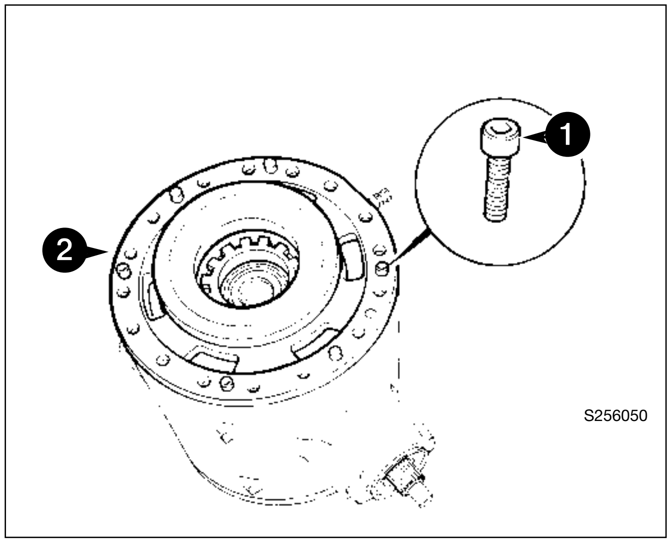
Torque Settings

Item	Nm	kgf m	lbf ft
A	40 - 48	4.08 - 4.90	29.5 - 35.4
D	680	69	500
F	476	49	351

Drive Head Maxtrac - Dismantling

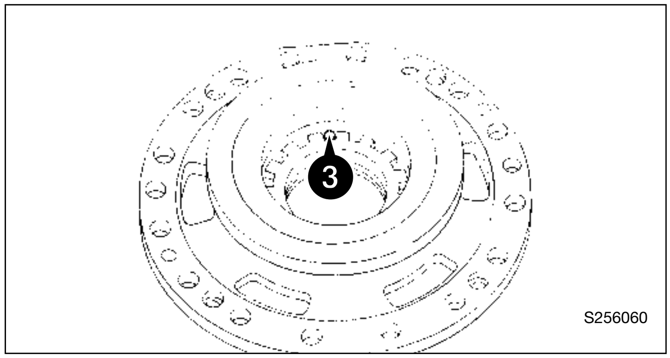
As the drivehead cannot be dismantled whilst fitted on the machine, we recommend that the complete axle is removed, refer to **Rear Axle - Removal and Replacement**.

Note: The crownwheel and pinion are matched and should be renewed as a pair if either one is damaged or excessively worn. The two differential case halves are also matched as are the differential side gears and planet gears, do not use unmatched halves or gears.

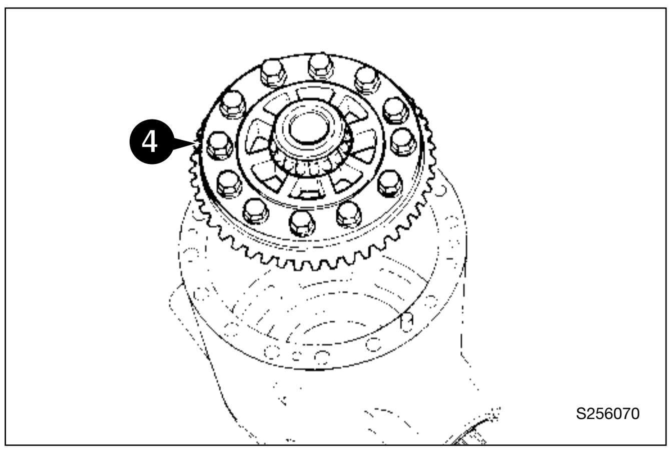


1 Position the drive head as shown, with the crownwheel at the top. Remove capscrews.

2 Match - mark the brake piston housing and drive head. Pull off the brake piston housing.

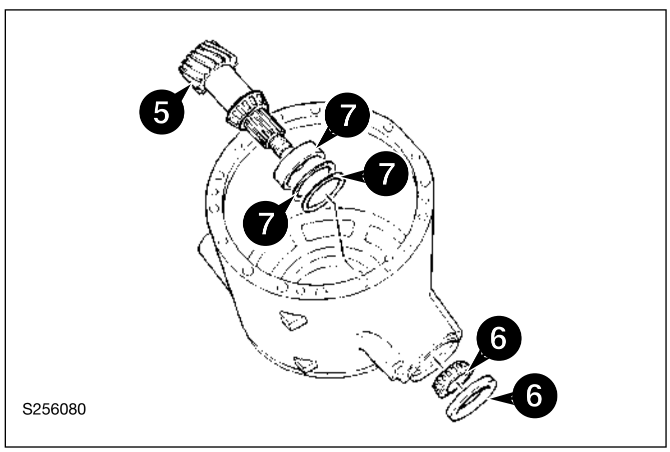


3 Drive out the differential side nut locking pin, to allow readjustment on assembly. Remove the other brake piston housing only if damaged, but remove its locking pin regardless (to allow sideload adjustment on assembly).



4 Lift out the crownwheel/differential assembly.

Note: If both brake piston housings are to be removed, mark the crownwheel end of the drive head casing to ensure that the assembly is returned to its original position.



5 Using a soft faced hammer, hit the pinion end shaft until the pinion is free from its front bearing, then withdraw the pinion.

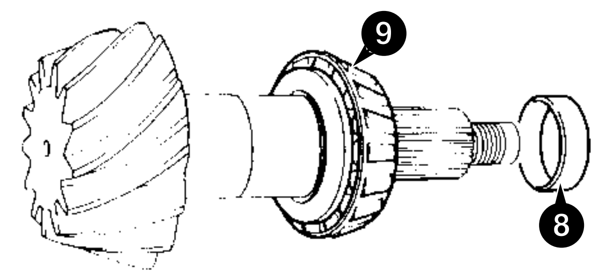
6 Withdraw the pinion seal and outer bearing cone.

7 If necessary, drive out the pinion inner bearing cup and shims. Discard the shims. Repeat for the outer bearing cup if required. Note that there are no shims for the outer bearing cup.

Drive Head Maxtrac - Dismantling (cont'd)

8 Remove and discard the pinion spacer.

9 Pull off the bearing cone.



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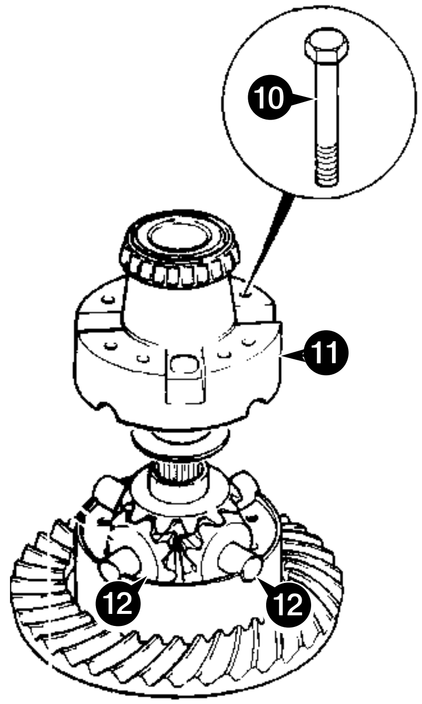
10 To dismantle the differential assembly, first remove bolts.

11 Lift off the top half housing.

12 Remove the differential gears and spherical washers. Pull off both differential bearing cones.



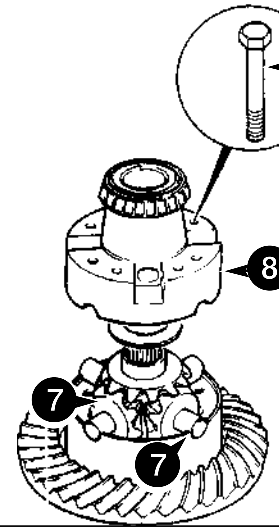
S256100

Drive Head Maxtrac - Assembly

Note: The crown wheel and pinion are matched and should be renewed as a pair if either one is damaged or excessively worn. The two differential housing halves are also matched. Do not use unmatched halves. If required, fit a new crownwheel to the differential case half, torque tighten crownwheel retaining bolts to 166 Nm 122 lbf ft; 17 kgf m).

7 Assemble the differential gears and their spherical washers into the bottom half housing. Fit the differential bearing cones.

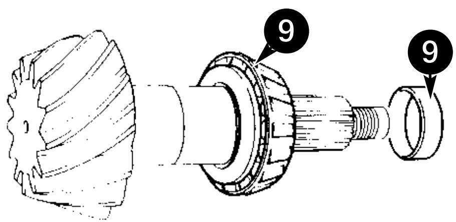
8 Position the top half housing onto the differential, aligning the match mark letters (see Note above). Apply JCB Threadlocker & Sealer to the threads of bolts, then fit and torque - tighten to 56 Nm (42 lbf ft, 6 kgf m). Check the gears for free rotation.



S256100

9 Fit the new inner bearing cone on to the pinion and the largest available solid spacer Eg (14.20 mm) from the solid spacer setting kit, refer to **Service Tools - Axles**.

Note: In the absence of the special tools required or the correct size solid spacer it is acceptable to fit a collapsible spacer, refer to **Collapsible Spacer Assembly**.



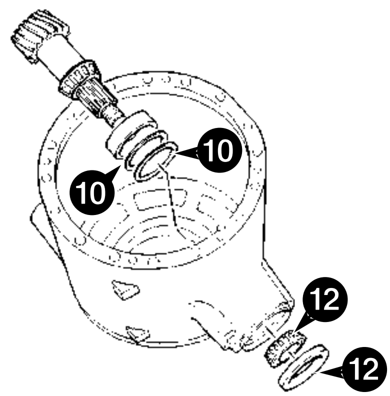
S256090

10 Determine the correct thickness required for the shims **10**, refer to **Pinion Depth Setting**.

11 Fit shims **10** behind the pinion inner bearing cup. To ensure the cup is fitted square, use a suitable puller assembly. Do not use a hammer. Fit the outer bearing cup.

12 Insert the pinion into its bore. (Before inserting, ensure that the pinion matches the crownwheel. The code numbers etched on the pinion end face and the crownwheel perimeter should be the same.

13 Fit the pinion outer bearing cone. Do not fit the oil seal at this stage.

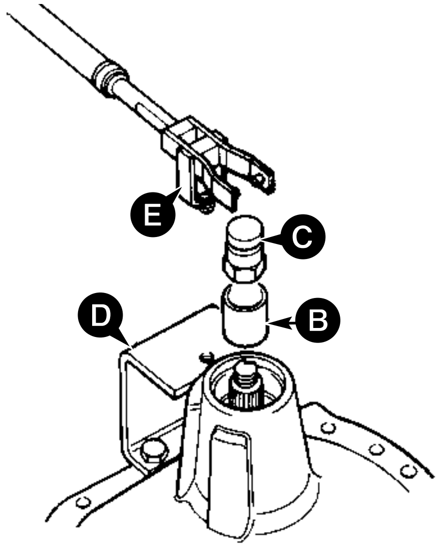


S256080

Drive Head Maxtrac - Assembly (cont'd)

14 Fit special tool sleeve **B** and special pinion shaft adapter **C**. Tighten adapter **C** to approximately 50 Nm, making sure the pinion is free to rotate and there is end float, this will prevent any damage to the bearing. If the pinion is not free to rotate or there is no end float at this stage check the bearing is fitted correctly. Also check the correct size spacer has been fitted.

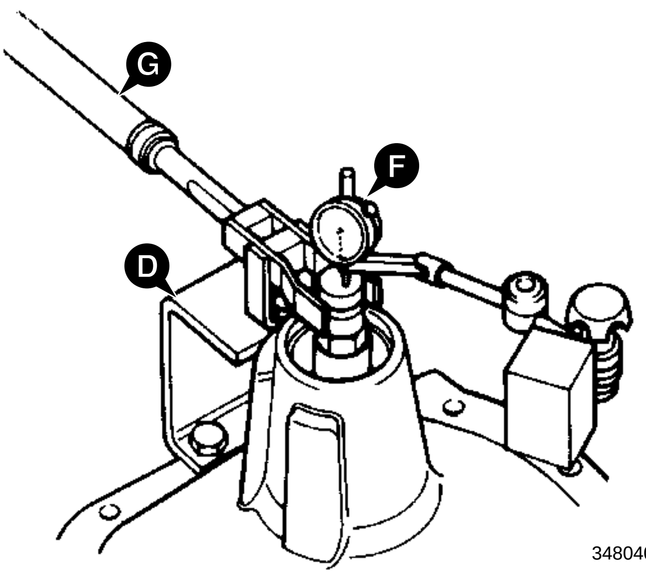
15 Fit special bracket **D** to the drive-head housing using two M10 x 30 nuts and bolts. Fit special tool support pillar **E** to bracket **D** so that the fork end engages in adapter **C**. Ensure that fork **E** is centrally located on adapter **C**. If necessary, re-align bracket **D** to suit.



348030

16 Fit dial test indicator (DTI) **F**. Ensure that the DTI is mounted on the drive head and not on bracket **D**.

17 Set torque wrench **G** to 35 Nm (25.8 lbf ft) and measure the end float while rotating the shaft.



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18 To select the right size solid spacer, subtract the end float obtained at step 17 from the solid spacer size (14.20 mm). Also subtract 0.04 mm to allow for theoretical bearing tolerance and pre load. The result is the size of spacer to be fitted from the solid spacer setting kit. If there is no spacer of this size, fit the next nearest size spacer, refer to **Service Tools - Axles**.

Example

Temporary spacer size	14.20
Subtract end-float	0.25
Total	13.95
Subtract tolerance & preload	0.04
Result	**13.91**

(No spacer available this size, use next nearest size spacer i.e 13.900)

19 Remove sleeve **B** and temporary spacer. fit correct size spacer from solid spacer setting kit, refer to **Service Tools - Axles**. During removal take care to avoid damaging the outer bearing.

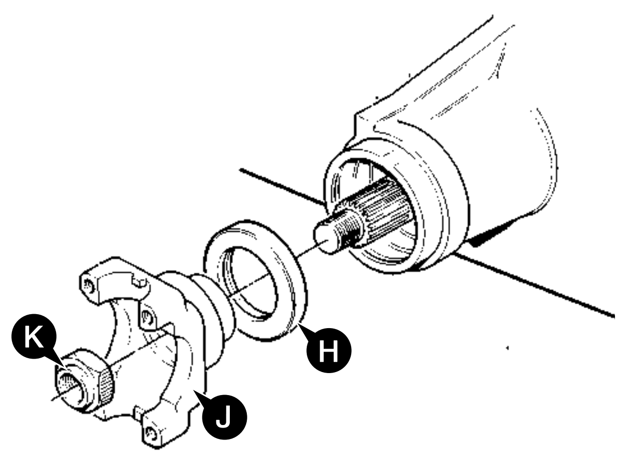
20 Fit sleeve **B.** Tighten adapter **C** to no more than 50 Nm to protect against bearing damage while spacer selection is verified making sure the pinion is free to rotate. Check there is no end float and pinion is free to turn smoothly by hand. Remove adapter **C** and fit stake nut **K.** Then check that rolling torque is less than 2.0 Nm. If the rolling torque exceeds 2.0 Nm, check that the shaft has been assembled correctly.

Note: If the pinion is not free to rotate check the correct size spacer has been fitted.

21 If rolling torque measured at step 20 is too high, fit the next larger size spacer. If rolling torque is too low, fit the next smallest size spacer. If a correct spacer is not available from the range, check that drive head is assembled correctly.

22 Remove adapter **C** and sleeve **B**.

23 Fit new oil seal **H**, grease between seal lips before fitting. Fit coupling yoke **J** and NEW stake nut **K**.



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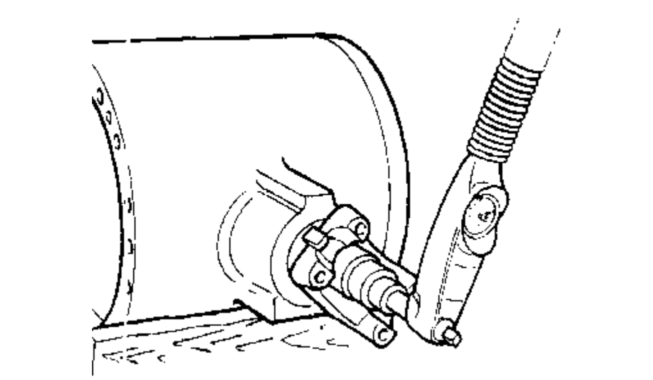
Drive Head Maxtrac - Assembly (cont'd)

24 Progressively torque tighten stake nut **K**, occasionally rotating coupling yoke, up to a minimum of 250 Nm. Providing the correct size spacer has been selected the rolling torque should be between 2.3 and 3.4 Nm including seal drag. When the torque is correct, stake the nut to the pinion shaft using a square-ended staking tool.

Note: The nut tightening torque can be increased to a maximum of 300 Nm provided that the pinion rolling torque does not exceed the maximum of 3.4 Nm.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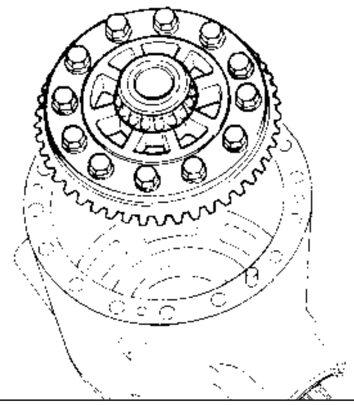
25 If both brake piston housings were removed, fit the one at the opposite end to the crownwheel, using the procedure in Step 16. Then install the crownwheel /differential assembly into the drive head.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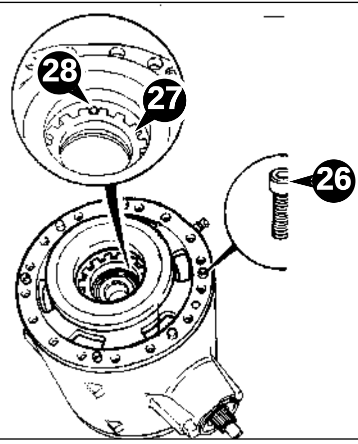
26 Apply JCB Multigasket to the drive head mating face, then fit the brake piston housing. Ensure that the match - marks made during dismantling are aligned. Fit capscrews. Torque - tighten to 56 Nm (42 lbf ft, 5.7 kgf m). (Applies to both piston housings.)

27 Adjust differential side nuts to give a bearing preload of 1.13-2.26 Nm (0.8-1.6 lbf ft; 0.1-0.2 kgf m). (Measure the preload by taking another rolling torque reading and subtracting the torque figure measured at step 24. The difference is the bearing preload.)



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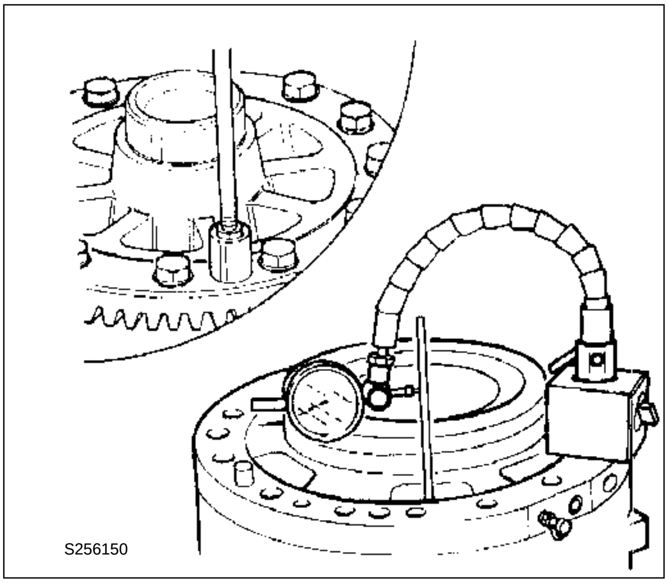
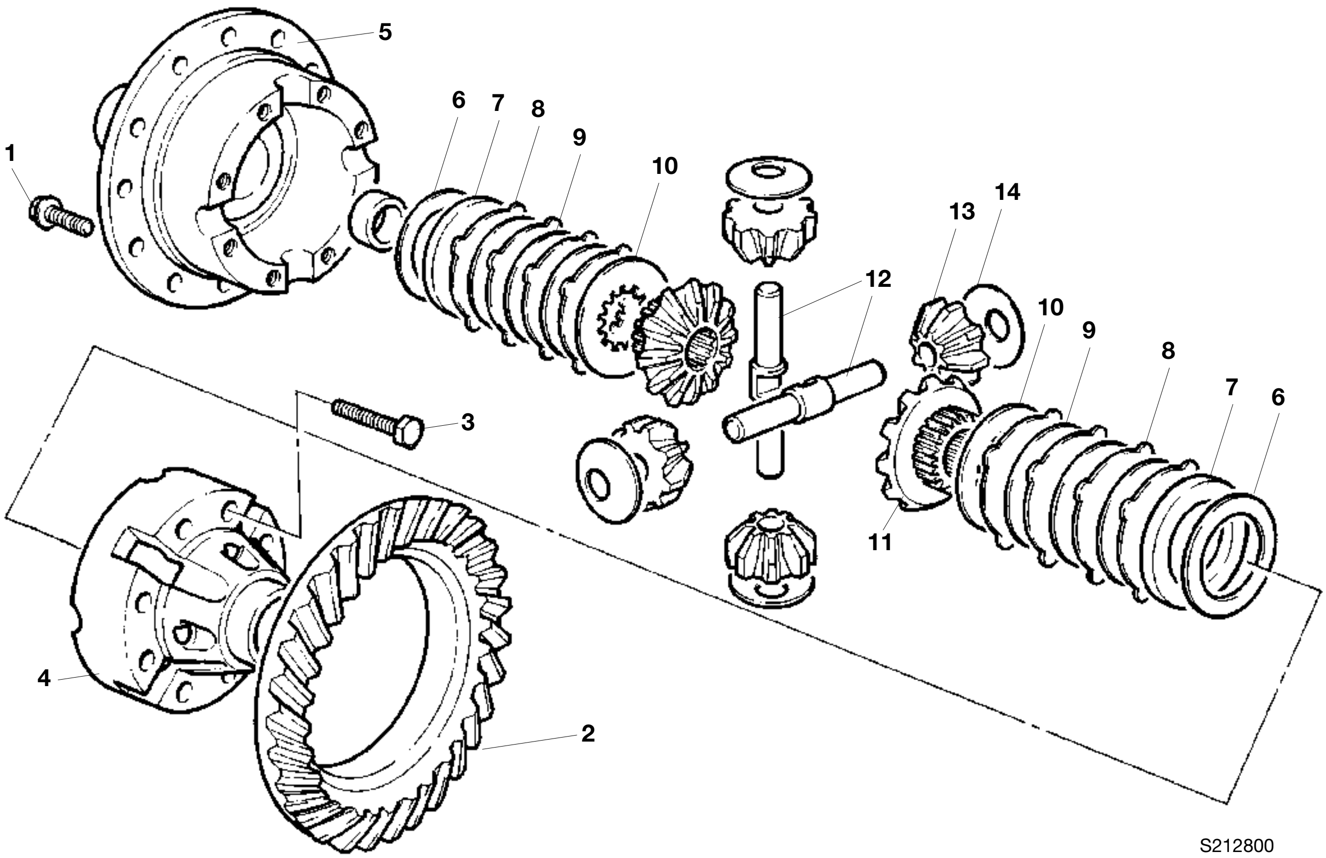
Drive Head Maxtrac - Assembly (cont'd)

28 Measure the crownwheel backlash, which should be 0.17 - 0.28 mm (0.006 - 0.010 in). Adjust the differential side nuts by equal amounts when altering backlash. When backlash and preload are both correct, fit the sidenut locking pins, see step 27.

29 Check tooth marking to verify crownwheel and pinion are set correctly, refer to **Crownwheel and Pinion Meshing**.



Limited Slip Differential



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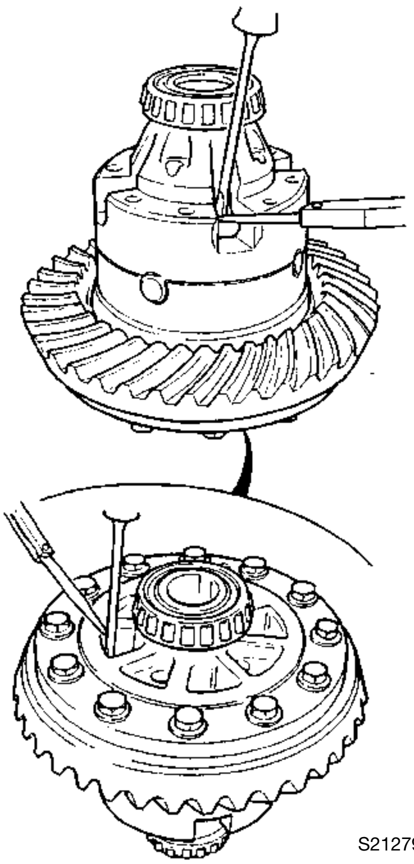

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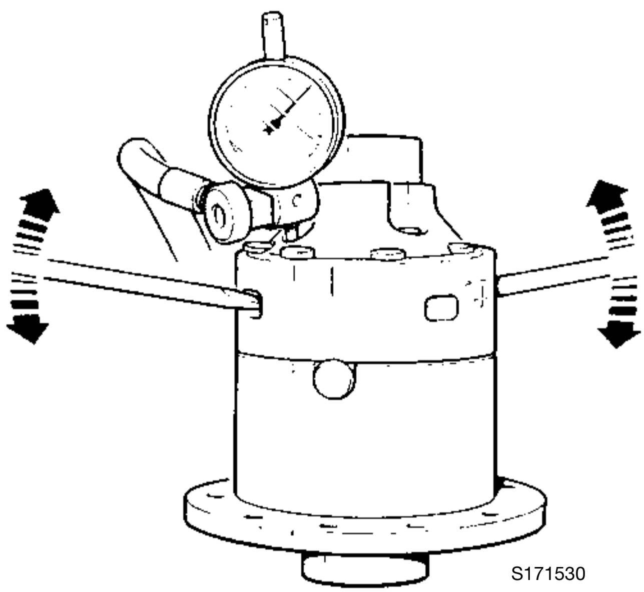

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Limited Slip Differential (Optional)

Dismantling

The numerical sequence shown on the illustration is intended as a guide to dismantling

The two differential halves are matched, before dismantling mark the two halves for subsequent assembly.

Note the relative positions of the friction and counter plates before dismantling, they must be fitted in the same positions.

If worn, the friction and counter plates must be renewed as a complete set.

Assembly

1 Assemble trunnion pins **12**, side gears **11** with pressure plates **10**, counter plates **8**, friction plates **9**, planet gears **13** and thrust washers **14** into the 'crownwheel half of the differential assembly **5**.

Note: Do not fit the shims **6** at this point.

2 Align the two halves of the differential assembly with the marks made during dismantling. Assemble using bolts **3**.

3 Using a dial test indicator (or feeler gauges), with two screwdrivers or suitable levers, gently apply pressure to side gear **11** away from the trunnion pins **12** as shown. Measure and note the end-float of the side gear.

4 Turn the differential assembly over and repeat step 3 for the second side gear.

5 Dismantle the differential assembly. Add shims **6** to give end-float between 0.1 and 0.2mm (0.004 and 0.008in.).

Note: Shimming must be carried out whenever the differential is dismantled, however the end float 0.1 and 0.2 mm (0.004 and 0.008 in.) can be exceeded on previously assembled differential as this is only an initial setting figure which allows for bedding in.

6 Repeat steps 2, 3, and 4. If the end float is correct, tighten bolts **3** to 56 Nm (41 lbf ft).

7 Fit crownwheel **2** using new Verbus Ripp bolts **1**, tighten bolts to 166 Nm (122 lbf ft).

Friction Plate Wear Limits

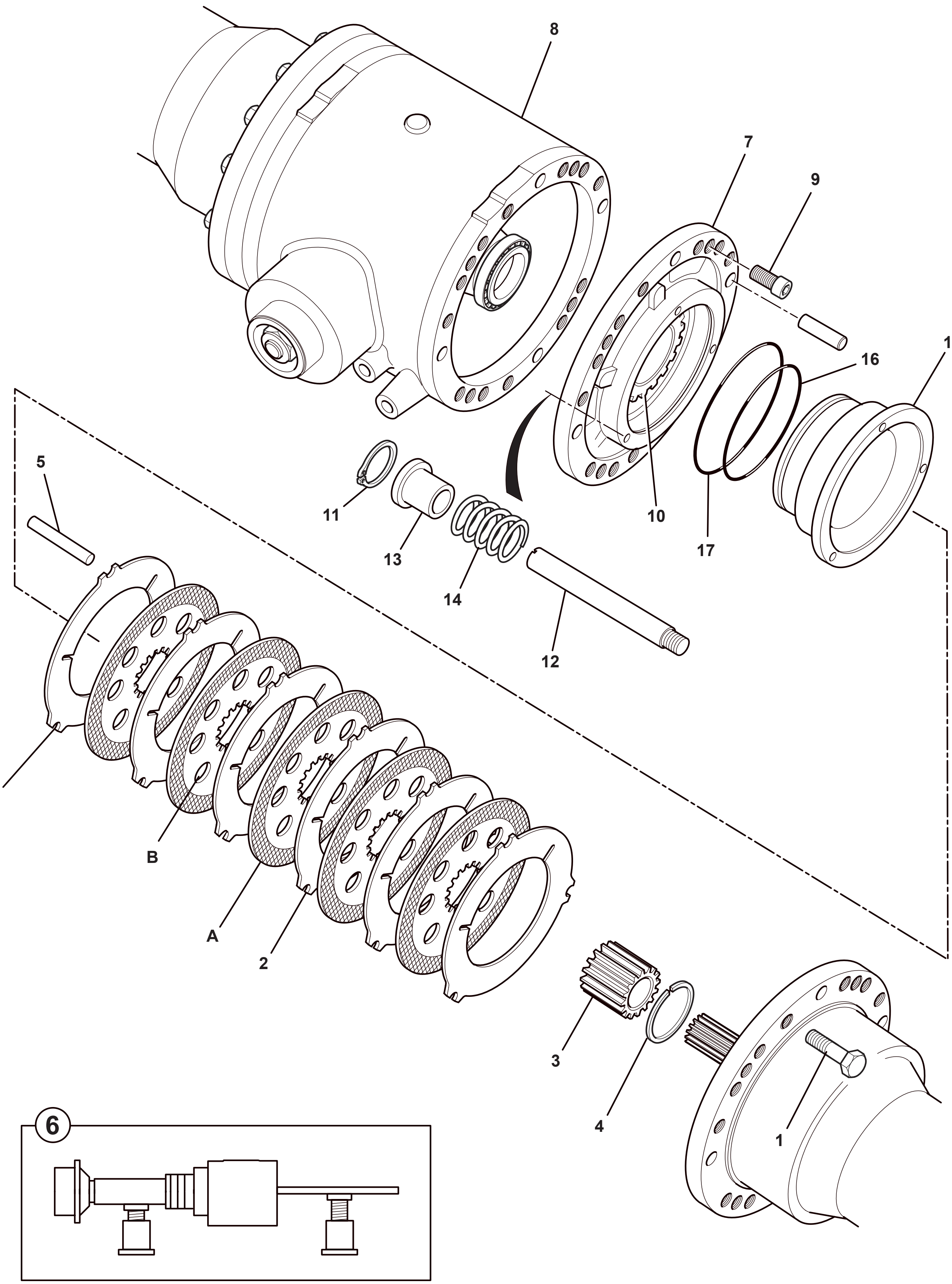
Measure and note the thickness of the friction plate, the result must not be less than 1.25 mm (0.049 in).

Check the condition of the friction material, which should be even over both surfaces.

If in doubt, discard the set (friction and counter plates).

Axle Hub and Driveshaft - Dismantling and Assembly

The rear axle hub and driveshaft dismantling and assembly procedure is identical to the front axle, refer to **Front Axle - Axle Hub and Driveshaft - Dismantling and Assembly**.



378121

Brakes

Dismantling

Axles are fitted with brake controlled back off to maintain a constant clearance of 0.6mm (0.02in) within the brake pack.

It is important that only one side at a time is dismantled to prevent damage to the bearings and preserve the crownwheel and pinion backlash setting.

⚠ WARNING

A raised and badly supported machine can fall on you. Position the machine on a firm, level surface before raising one end. Ensure the other end is securely chocked. Do not rely solely on the machine hydraulics or jacks to support the machine when working under it.

Disconnect the battery, to prevent the engine being started while you are beneath the machine.
GEN 1-1

1 It is recommended that the axle be removed from the machine when dismantling the rear axle brakes, refer to **Rear Axle - Removal and Replacement**.

2 Remove bolts **1**. Use a heavy duty socket to unscrew them.

3 Jack the axle arm off the drive head, using the drive head securing bolts. Remove all traces of the old sealant from the mating faces.

Note: The brake pack comprises five friction plates and six counter plates. There are two counterplates **2**, one at each end of the brake pack, which are not secured to the plate carrier **3**. If the plates are to be re-used, note their positions and which way round they are then withdraw the brake pack.

4 Remove the circlip **4**. If the brake pack is to be re-used, note the positions of the plates before removing them.

5 Wear limit of friction plates is to the depth of the cross hatching **A**. Check all plates for flatness and damage. (Some scoring of the counterplates is normal.) Renew the brake pack complete if worn or damaged. Do not renew individual plates.

6 Remove the three reaction pins **5**. Inspect for damage.

Note: If new brake and friction plates are being fitted new brake back off pins and tension bushes must also be fitted. Failure to do so could result in the brake being permanently on.

7 Before removing the brake housing and piston assembly support the differential with a drive shaft or other suitable support, as shown at **6**.

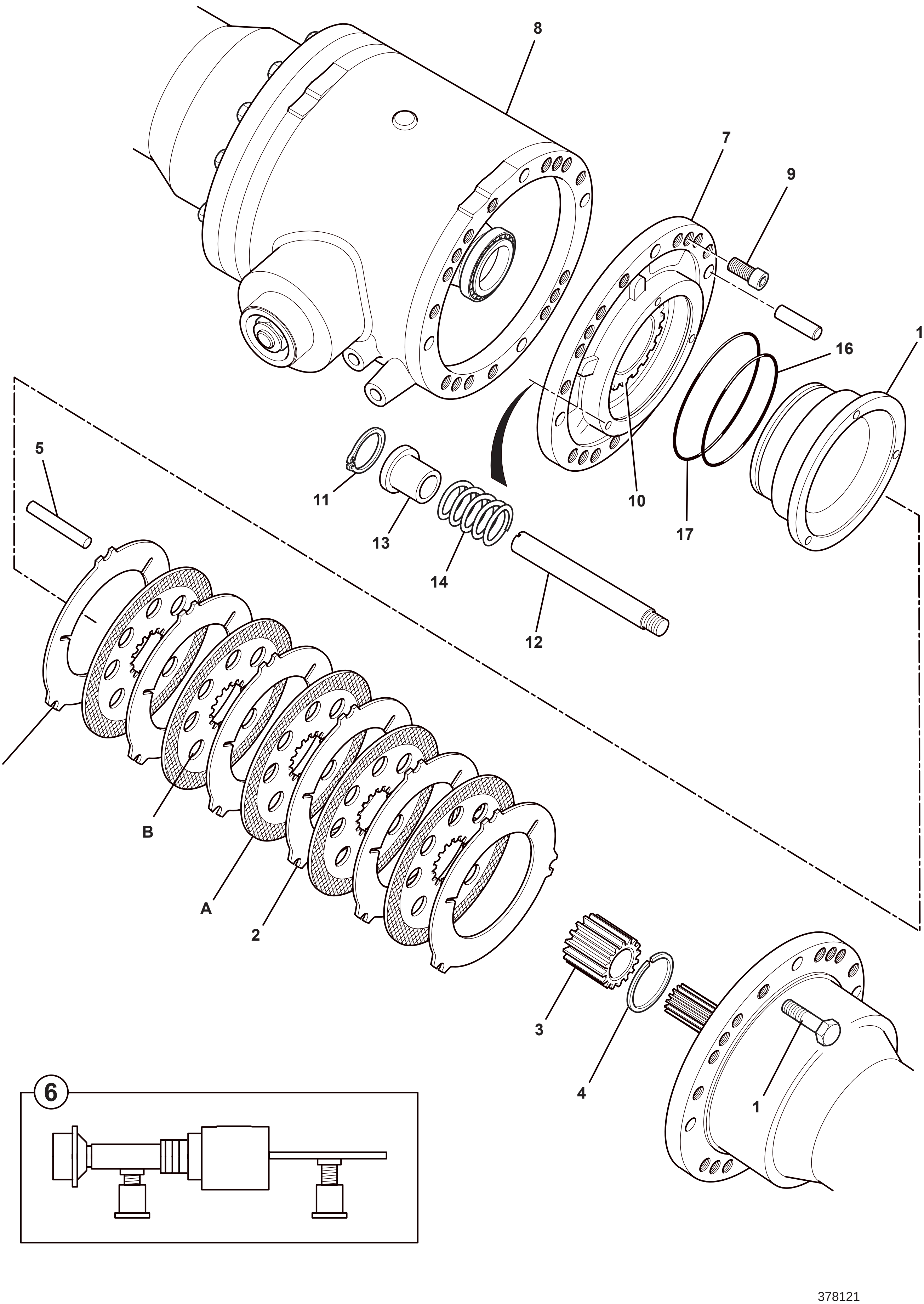
8 Match mark the brake piston housing **7** and the drive head. Undo four capscrews **9** and remove the brake housing and piston assembly.

Note: Do not disturb nut **10** otherwise the bearing pre load will have to be reset.

9 Remove circlips **11**, remove back off pins **12**, tension bushes **13** and springs **14**.

10 Remove brake piston **15** from brake housing **7**.

11 Remove and discard seals **16** and **17**. Inspect the housing bore for damage and scoring. Nicks or cuts in the seals may be responsible for loss of brake fluid.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378121

Brakes

Assembly

1 Remove all traces of old sealant from the mating faces of the drive head and the brake piston housing.

2 Fit new seals **17** and **16**. Make sure they seat squarely in their grooves.

3 Carefully press the piston **15** all the way into its housing **7**. Make sure the brake back off holes in the piston and housing align.

4 Apply JCB Threadlocker and Sealer to threads of back off pins **12**. Screw the back off pins **12** into the brake piston and fit the springs **14** over the back off pins.

5 Place the tension bush **13** over the back off pin **12**. Using a suitable tool (steel tube) drive the tension bush onto the back off pin using a soft face hammer until the circlip **11** can just be fitted.

6 Apply JCB Multigasket to the drive head mating face, then fit the brake piston housing assembly. Ensure that the match marks made during dismantling are aligned.

7 Fit capscrews **9** and torque tighten to 56 Nm (42 lbf ft, 5.7 kgf m).

8 Remove the differential support.

9 Assemble the five friction plates and six counterplates **2** onto the brake carrier **3**. If the original brake pack is being re-used, return the plates to their original positions, refer to **Dismantling**. Soak new friction plates in JCB Special Gear Oil before assembly. Fit circlip **4**.

Note: On assembly of the brake packs, the oil flow holes **B** must be aligned with each other when being fitted to the brake plate carrier.

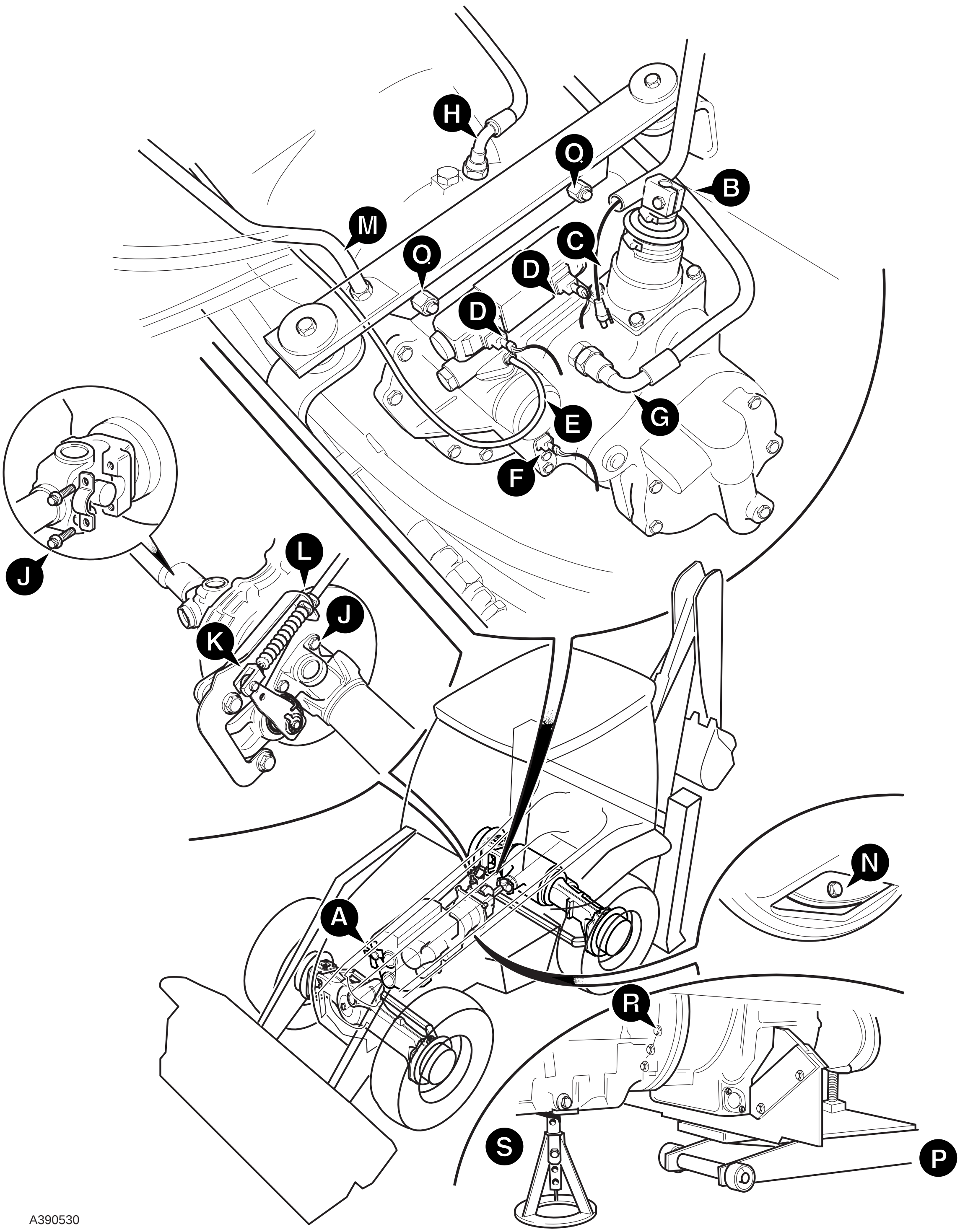
10 Locate the three reaction pins **5** into their grooves, securing them with grease. Push the pins fully into their location holes in the housing.

11 Install one counterplate **2** into the housing, then the brake pack, then the other counterplate. Return re-used counterplates to their original positions. Push the brake pack fully home.

12 Apply JCB Multigasket to the mating face of the drive head, and JCB Threadlocker and Sealer to the threads of bolts **1**. Locate the axle arm onto the drivehead, with the embossed word 'TOP' on the axle arm uppermost.

13 Fit bolts **1** and torque tighten to 98Nm (72lbf ft, 10 kgf m).

Removal and Replacement



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Removal and Replacement

Park the machine on firm level ground.

⚠ WARNING

A raised and badly supported machine can fall on you. Position the machine on a firm, level surface. Before raising one end ensure the other end is securely chocked. Do not rely solely on the machine hydraulics or jacks to support the machine when working under it.

Disconnect the battery, to prevent the engine being started while you are beneath the machine.
GEN 1-1

Removal

1 Rest the loader shovel on the ground and lower the stabiliser legs to raise the machine sufficiently to allow room for the transmission to be pulled clear. Block/support the machine.

2 Drain the synchro shuttle gearbox oil, refer to Section 3 **Syncro Shuttle Transmission - Change Oil and Clean Strainer**.

3 Remove the engine bonnet, refer to Section 3 **Engine Panels - Opening and Closing the Bonnet**.

4 Remove the engine fan retaining bolts as shown at **A** (4 off) and remove the fan, see note 1.

Note 1: At a later stage the transmission is tilted to give access to retaining bolts, if the fan is not removed at this stage it will foul.

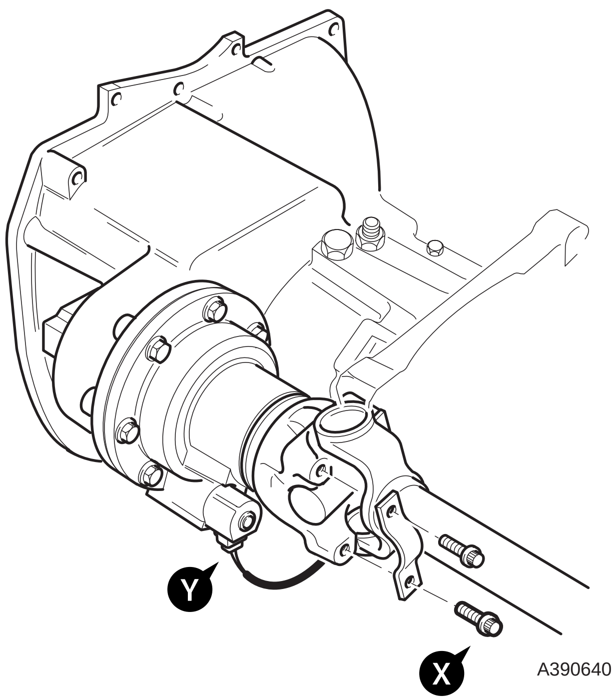
5 In the cab remove the floor mat and open the inspection cover in the cab floor to gain access the top of the syncro shuttle gearbox and carryout the following, see note 2.

- a Disconnect the gearshift lever **B** from the top of the gearbox.
- b Disconnect the flying lead connector to the transmission dump switch as shown at **C**.
- c Disconnect the solenoid valve flying lead connectors **D**.
- d Disconnect the breather pipe from the pressure maintaining valve block and the top of the dipstick tube as shown at **E**.
- e Disconnect the gearbox oil pressure switch flying lead connector as shown at **F**.
- f Disconnect the gearbox oil cooler hoses **G** and **H**, blank off all exposed connections.

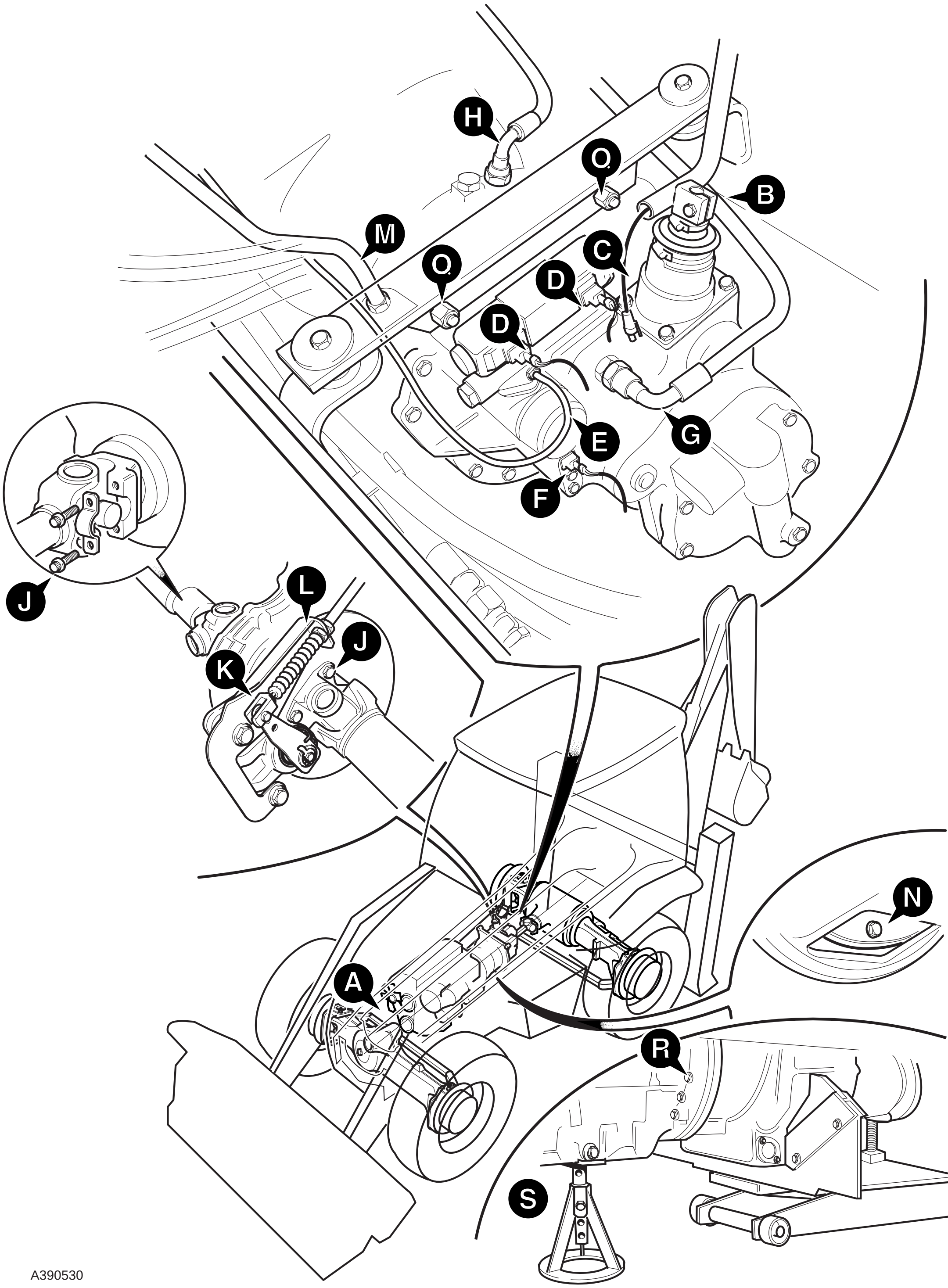
Note 2: Label the hoses and the electrical connectors for identification when refitting.

6 Remove front and rear axle drive shaft bolts **J**.

7 For machines fitted with the power take off option, remove the PTO drive shaft bolts **X**, and the PTO solenoid valve flying lead connector as shown at **Y**.



Removal and Replacement



Removal and Replacement (cont'd)

8 Disengage the parking brake clevis at the parking brake calliper as shown at **K**, loosen the locknuts **L** and remove the cable from the bracket, tie the cable up clear of the gearbox.

9 Remove the transmission dipstick tube **M**.

10 Remove the access bung/plate at the bottom of the flywheel housing. Through the access hole, loosen and remove the torque convertor to engine flywheel retaining bolts **N**.

11 Support the transmission with a trolley jack as shown at **P**, see note 3.

12 Make sure that the weight of the transmission is supported by the trolley jack and remove the gearbox mounting bolts **Q** on the transmission cross mount.

Note 3: Attach a 'cradle' to the trolley jack that will partially embrace the transmission.

13 Using the trolley jack, lower the transmission and engine to gain access to the top flywheel housing to engine block retaining bolts **R**.

14 Put a support under the engine as shown at **S** to prevent it from dropping when the transmission is removed.

15 Remove the flywheel housing to engine bolts **R**.

16 Manoeuvre the transmission with the torque convertor clear of the engine housing.

17 Lower the trolley jack and pull the transmission and torque convertor clear of the machine.

Replacement

Replacement is a reversal of the removal procedure.

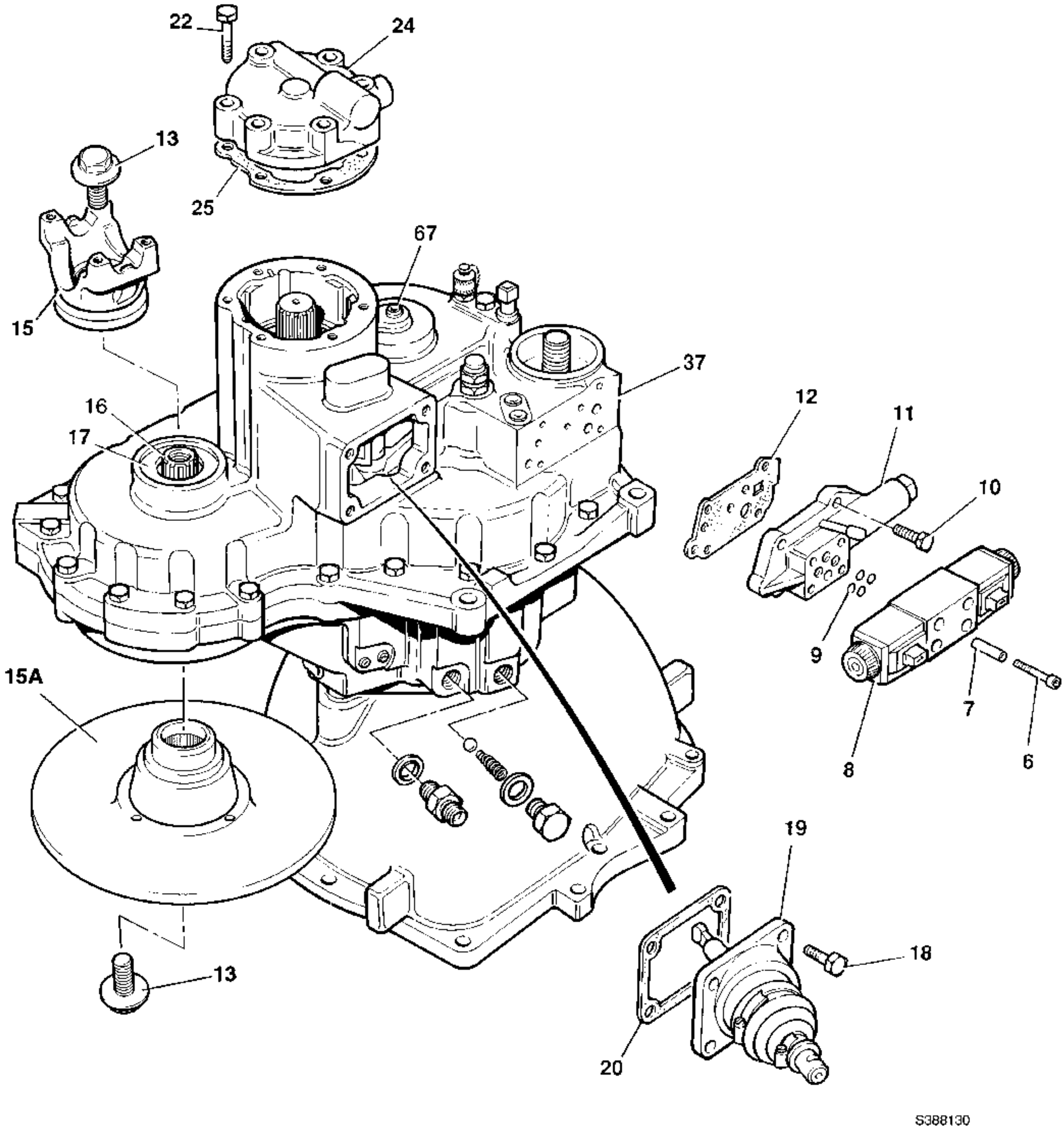
Set the parking brake cable as described in Section G **Service Procedures, Parking Brake - Adjustment**. If the parking brake calliper has been removed reset central to the parking brake disc, refer to Section G **Parking Brake - Calliper Removal and Replacement**.

Set the torque converter as described in **Torque Converter**.

Fill the transmission with the specified amount of JCB Special Transmission Fluid (refer to Section 3 **Lubricants and Capacities** and **Syncro Shuttle Transmission, Changing the Oil and Filter**). Leave hose **G** off until the filling operation is complete. After filling refit hose **G**.

Torque Settings

Item	Nm	kgf m	lbf ft
A	25	2.5	18
J	40 - 48	4.08 - 4.9	29.5 - 35.4
N	44	4.5	32
Q	237	24	175
R	98	10	72
X	20.9 - 23.7	2.13 - 2.42	15.4 - 17.5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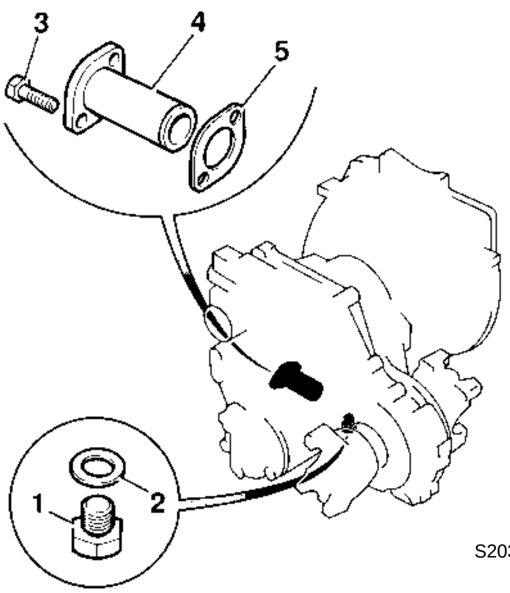
Dismantling

1 Drain the oil from the casing into a suitable container by removing the drain plug **1** and sealing washer **2**. Discard the sealing washer.

2 Remove suction strainer retaining bolts **3** and remove the strainer **4**. Remove and discard the strainer cap gasket **5**.

3 Remove and discard the oil filter.



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4 Position the gearbox with the rear casing **37** uppermost.

5 Unscrew capscrews **6** and remove spacers **7** (4 off). Remove the solenoid valve assembly **8.** Retain the spacers (4 off) but discard the 'O' rings **9** (4 off).

6 Remove output yoke **15** and brake disc **15A** attachment bolts **13** using service tool 892/00812. Remove yoke **15** and brake disc **15A** from the output shaft **16**.

7 Remove and discard the output shaft oil seals **17**.

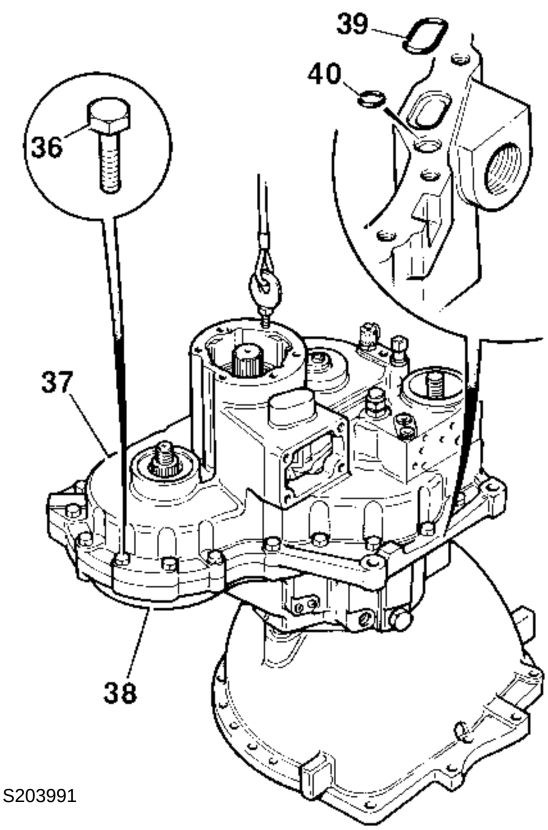
8 Remove the gear change turret retaining bolts **18** (4 off). Remove the turret **19** and gasket **20**. Discard the gasket.

9 Remove layshaft cover plate retaining bolts **22 (6 off)**, remove cover plate **24**, discard gasket **25**.

10 Remove the adaptor block assembly retaining setscrews **10** (4 off) and remove the block **11**. Remove and discard the gasket **12.**

11 Remove the casing retaining bolts **36**.

12 Screw a lifting eye into a layshaft end cover bolt hole. Using a suitable hoist, lift the rear casing **37** away from the front casing **38**. Pry bars may be used at the points provided to assist in 'cracking' the joint. Remove and discard the face 'O' rings **39** and **40**.



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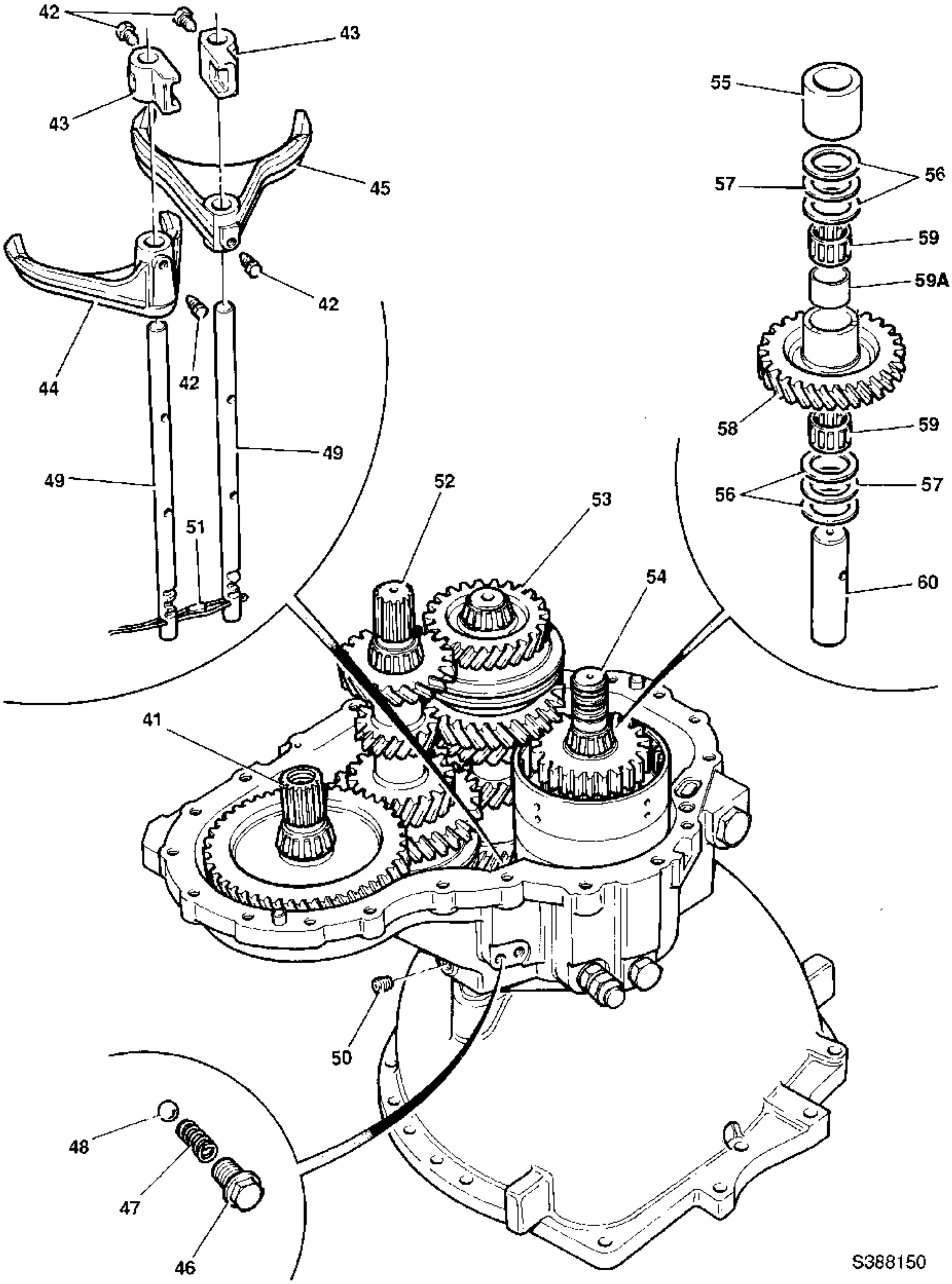
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Dismantling (Cont'd)

13 Remove the output shaft assembly **41.**

14 Remove locking screws **42** (2 off) from selector forks **44** and **45**.

15 Remove the detent plugs **46**, springs **47** and balls **48** (2 off each).

16 Slide selector shafts **49** from selector forks **44** and **45**.

17 Remove taper plug **50** from the casing. Thread a piece of thin looped wire to the bottom of the RH selector shaft locating hole. Using a small diameter screwdriver through the taper plug hole, push the baulk roller **51** into the wire loop. Carefully withdraw the baulk roller.

18 Remove the layshaft assembly **52**.

19 Remove the main shaft assembly **53**.

20 Remove the reverser unit **54**. See page 62-1 for Dismantling and Assembly instructions.

21 Remove idler gear spacer **55**, thrust washers **56**, thrust bearing **57**, idler gear **58**, needle roller bearings **59**, bearing spacer **59A**, thrust washers **56** and thrust bearing **57** from idler shaft **60.**

22 Remove the idler shaft **60** using a slide hammer if necessary.

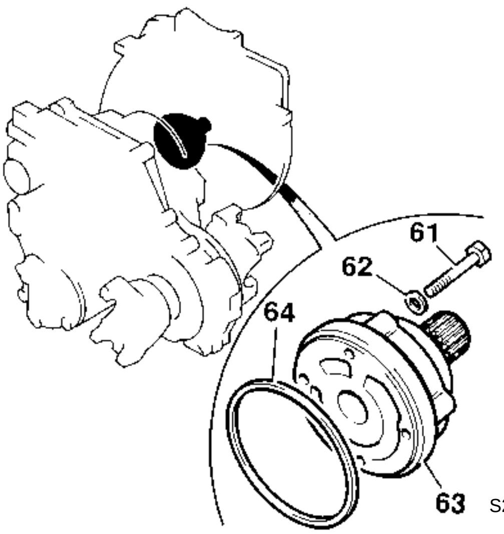
23 Remove the bearing cups located in the front casing using a slide hammer.

24 Turn the gearbox into the horizontal position.

25 Remove the pump assembly retaining bolts **61** (4 off) and washers **62** (4 off) and withdraw the pump assembly **63**. Remove and discard 'O' ring **64**.

26 Remove the pump and shaft from the pump case.

27 Remove the bearing cups located in the rear casing using a slide hammer.



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Assembly

Note: All bearings must be lightly oiled before assembly. Make sure all components are thoroughly clean and renew all 'O' rings.

1 Clean the mating faces of front casing **38** and rear casing **37**.

2 Fit new bearing cups into front and rear casings using a bearing dolly.

3 Fit the idler shaft **60** using a soft faced hammer.

4 Fit the idler gear assembly (thrust washers **56**, thrust bearing **57**, needle roller bearings **59**, bearing spacer **59A**, idler gear **58**, thrust washers **56**, thrust bearing **57** and idler gear spacer **55**).

5 Fit the reverser unit **54**.

6 Fit the main shaft assembly **53**.

7 Fit the layshaft assembly **52**.

8 Fit the output shaft assembly **41**.

9 Thread the RH gear selector rod **49** through selector fork **45** and into the casing. Secure with locking screw **42**. Torque tighten to 35 Nm (25.8 lbf ft).

10 Using a piece of looped wire, lower the baulk roller **51** down the LH selector rod channel in the casing. When in position at the bottom, push the roller into position using a small screwdriver through the taper plug hole (item **50**). Remove the wire and screwdriver. Fit the taper plug **50** and torque tighten to 28 Nm (20.7 lbf ft).

11 Thread the LH selector rod **49** through selector fork **44** and into the casing. Secure with locking screw **42.** Torque tighten to 35 Nm (25.8 lbf ft).

12 Fit detent balls **48**, springs **47** and plugs **46** (2 off each). Torque tighten plugs to 35 Nm (25.8 lbf ft).

13 Screw a lifting eye into a layshaft housing bolt hole of the rear casing **37**. Using a suitable hoist, lift the rear casing into position over the front casing **38**. Carefully lower the rear casing onto the front casing, ensuring that the locating pegs are fully engaged. Secure the casings with six equally spaced bolts **36**. Torque tighten to 56 Nm (41.3 lbf ft). Remove the lifting eye.

Assembly (Cont'd)

Shaft End Float Measurements

14 Clean the layshaft end cover mating face.

15 Using service tool kit 993/59400, fit base plate **A** onto the layshaft end cover mating face and secure with socket head set screws **B**. Torque tighten to 56 Nm (41.3 lbf ft).

16 Pass the adaptor **C** through the large diameter hole in the base plate and screw into the end of the layshaft.

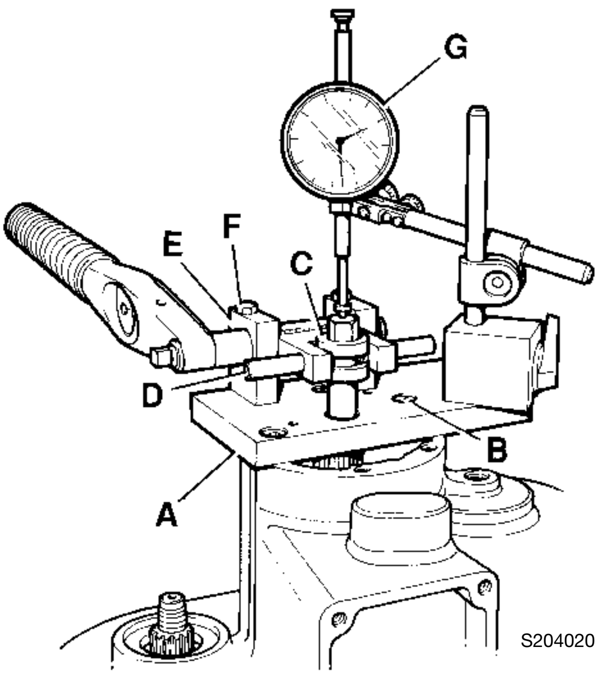
17 Fit the lever arm pegs **D** into the adaptor annular space. Position the lever unit mounting blocks **E** on the base plate and secure with bolts **F**. Tighten the bolts.

18 Fit a magnetic base dial test indicator (DTI) **G** onto the base plate with the pin resting on the top of the adaptor.

19 Measure layshaft end float as follows (refer to view **W**):

a Using a torque spanner on the nut of the lever unit as shown, apply a torque of 30 Nm (22.1 lbf ft) clockwise while turning the output shaft backwards and forwards using a turning handle. Zero the DTI.

b Apply a torque of 30 Nm (22.1 lbf ft) anti-clockwise while turning the output shaft backwards and forwards using a turning handle. Take the layshaft end float reading from the DTI.



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20 Calculate the required shim thickness.

Example:

a End Float Tolerance : 0.03 to 0.08 mm. (Identical clearance for all shafts.)

b Measured End Float : 0.20 mm

c To give an end float within the tolerance, subtract 0.05mm from dimension at para. b for the required shim thickness,
e.g., 0.20 - 0.05 = 0.15 mm.

21 Remove the bolts **F** securing the lever unit mounting blocks **E** and remove the lever unit. Unscrew and remove the adaptor **C**.

22 Remove taper plug **67**.

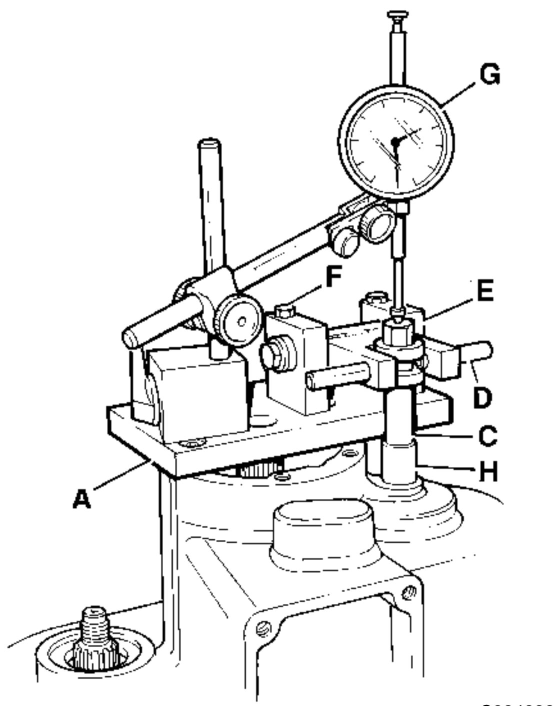
23 Fit the short extension **H** to the adaptor **C**.

24 Using a lever, put the gearbox in gear.

25 Screw the adaptor into the end of the main shaft. Fit the lever arm pegs **D** into the adaptor annular space. Position the lever unit mounting blocks **E** in the appropriate position on the base plate **A** and secure with bolts **F**. Tighten the bolts.

26 Fit a magnetic base DTI **G** onto the base plate with the pin resting on the top of the adaptor.

27 Measure main shaft end float and determine shim thickness by repeating steps 19 and 20. Refer to view **X**.



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Assembly (Cont'd)

28 Temporarily refit taper plug **67**.

29 Remove short extension from adaptor.

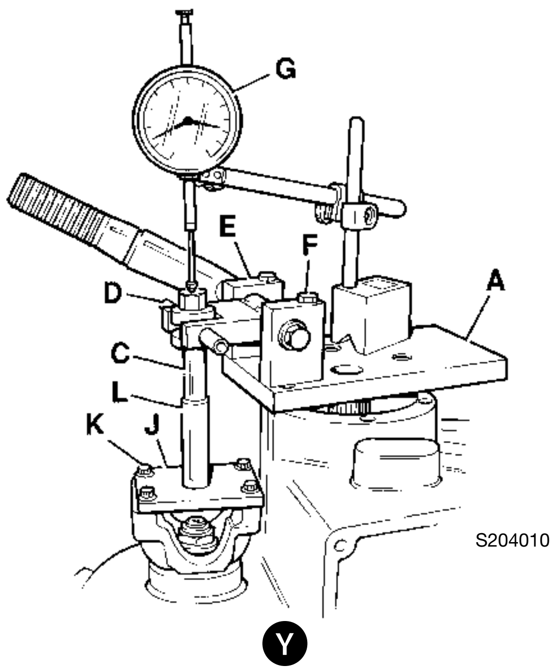
30 Fit the rear output yoke **15** and attachment bolt **13.** Torque tighten to 350 Nm (258.2 lbf ft).

31 Fit the output yoke adaptor **J** and secure with bolts **K**. Torque tighten to 22 Nm (16.2 lbf ft). Screw the adaptor **C** into the yoke adaptor extension **L** until tight.

32 Fit the lever arm pegs **D** into the adaptor annular space. Position the lever unit mounting blocks **E** in the appropriate position on the base plate **A** and secure with bolts **F**. Tighten the bolts.

33 Fit a magnetic base DTI **G** onto the base plate with the pin resting on the top of the adaptor.

34 Measure the output shaft end float and determine shim thickness by repeating steps 19 and 20. Refer to view **Y**.



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35 Remove the lever unit, adaptor, base plate and output yoke adaptor.

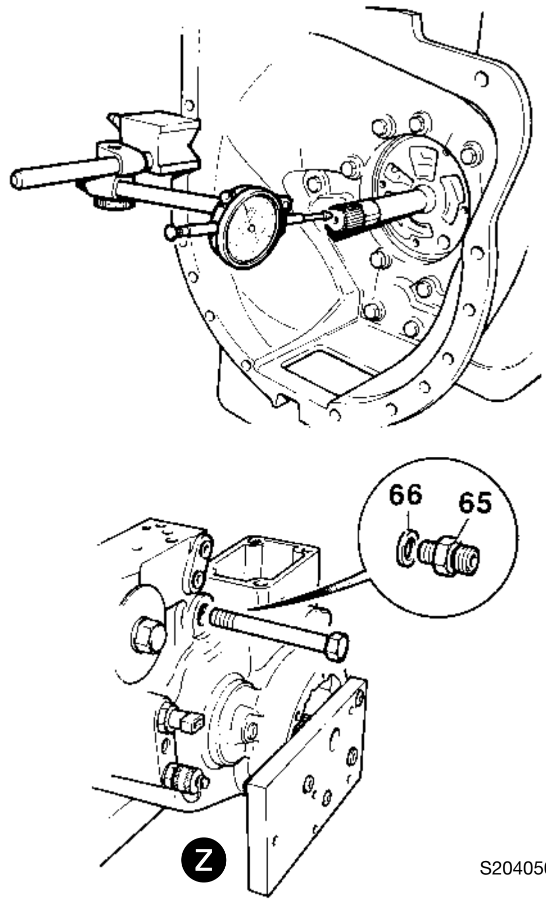
36 Remove the attachment bolt **13** and output yoke **15**.

37 Remove oil inlet adaptor **65** and sealing washer **66** from the rear casing.

38 Turn the gearbox into the horizontal position.

39 Clean the mounting face of the flywheel housing. Mount the DTI on the face with the probe resting on the end of the reverser unit shaft. Firmly press the reverser unit shaft in to take up any shaft end float. Zero the DTI. Refer to view **Z**.

40 Screw a threaded bolt or rod into the threads exposed when oil inlet adaptor **65** was removed, until it touches the end of the reverser unit shaft.



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41 Screw bolt or rod in further (approx. 10 Nm; 7.4 lbf ft) whilst turning output shaft. Stop when increasing resistance is felt. DO NOT overtighten. Take the DTI reading.

42 Calculate the required shim thickness as detailed in step 20.

43 Remove bolt or rod and the DTI. Temporarily refit oil inlet adaptor **65** and sealing washer **66**.

44 Turn the gearbox into the vertical position, with the rear casing upwards.

45 Screw a lifting eye into a layshaft end cover bolt hole. Using a suitable hoist, lift the rear casing **37** away from the front casing **38**. Pry bars may be used at the points provided to assist in 'cracking' the joint. Turn the rear casing over.

Assembly (Cont'd)

46 Using a bearing puller, remove the layshaft bearing cup from the rear casing. Referring to the shim thickness calculation for the layshaft **52,** fit the required shims into the rear casing. Using a bearing dolly, refit the layshaft bearing cup.

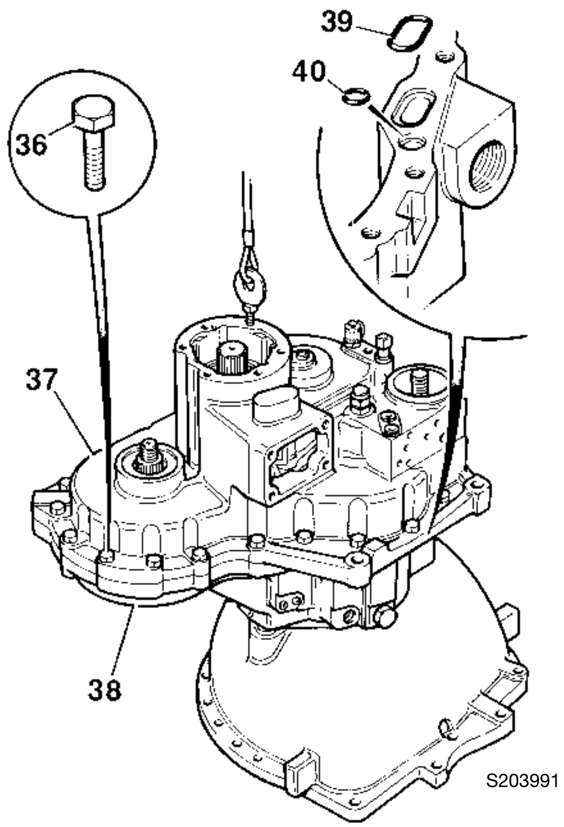
47 Repeat step 46 for the main shaft **53**, output shaft **41** and reverser unit **54**.

48 Turn the rear casing over.

49 Fit the face 'O' rings **39** and **40** into the front case mating face recesses.

50 Apply a bead of sealant to the front case mating face, smoothing the sealant around the 'O' ring areas.

51 Screw a lifting eye into the layshaft end cover bolt hole of the rear casing **37.** Using a suitable hoist, lift the rear casing into position over the front casing **38.** Carefully lower the rear case onto the front case, ensuring that the locating pegs are fully engaged. Secure the casings with bolts **36.** Torque tighten to 56 Nm (41.3 lbf ft). Remove the lifting eye.



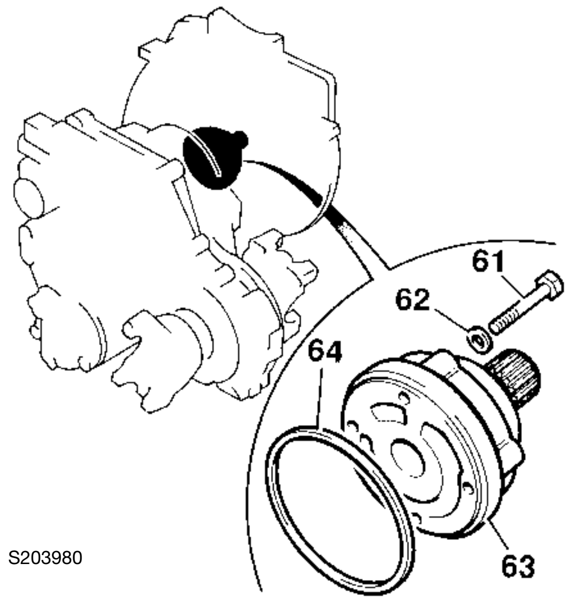
52 Repeat end float measurements, as detailed in steps 15 to 36 inclusive, to check that end float on all shafts remains within the tolerance of 0.03 to 0.08 mm.

53 If any measurement is outside the tolerance, remove rear casing, see step 45. Using a bearing puller, remove the bearing cap(s) of the shaft(s) that is outside the tolerance. Add or remove shim(s) to bring the measurement(s) within the tolerance. Using a bearing dolly, refit the bearing cup(s) into the rear casing.

54 Remove the front case 'O' rings **39** and **40** and clean the sealant from the front case mating face.

55 Repeat steps 49 to 52 inclusive. The end float measurements should now be within the tolerance for all shafts. If any measurement is still outside the tolerance, repeat step 53.

56 Turn the gearbox into the horizontal position. Fit new 'O' ring **64** to the oil pump assembly. Refit the oil pump assembly and secure with new washers **62** and bolts **61.** Torque tighten to 28 Nm (20.7 lbf ft). Make sure that the pump rotors rotate.



57 Pack the cavity between the lips of both front and rear output shaft oil seals **17** with grease and fit the seals.

58 Fit the rear output yoke **15** and front output brake disc **15A** and secure with attachment bolts **13.** Do not fully tighten. Align the front and rear output yokes.

59 Fit the gear change turret **19** with a new gasket **20** and secure with setscrews **18.** Torque tighten to 56 Nm (41.3 lbf ft).

60 Fit oil inlet adaptor **65** with new sealing washer **66** into the rear casing. Torque tighten to 102 Nm (75.2 lbf ft).

61 Fit taper plug **67**. Torque tighten to 56 Nm (41.3 lbf ft).

Assembly (Cont'd)

62 Fit a new gasket **25**. Fit layshaft end cover **24**, torque tighten retaining bolts **22** (6 off) to 56 Nm (41.3 lbf ft.

63 Fit adaptor block assembly **11** and new gasket **12** to the rear casing. Secure with setscrews **10** and torque tighten to 10 Nm (7.4 lbf ft).

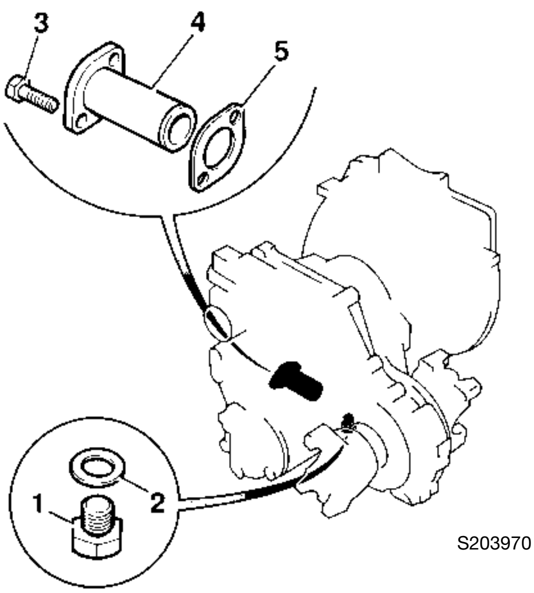
64 Fit new 'O' rings **9** to the underside of solenoid valve **8**. Fit solenoid onto the adaptor block assembly **11**, ensuring that 'O' rings remain in position in solenoid base. Secure solenoid using spacers **7** and cap screws **6** (4 off). Torque tighten to 5.8 Nm (4.3 lbf ft).

65 Fit a new gasket **5** to a clean suction strainer **4** and insert into the casing. Apply JCB Threadlocker and Sealer to the threads of setscrews **3** (2 off) and torque tighten to 10 Nm (7.4 lbf ft).

66 Torque tighten the output yoke and brake disc attachment bolts **13** to 350 Nm (258.2 lbf ft).

67 Fit drain plug **1** with new sealing washer **2**. Torque tighten to 102 Nm (75.2 lbf ft).

68 Fit a new oil filter.



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Dismantling

1 Carefully remove the piston ring seals **1** (3 off).

Note: If the piston ring seals are excessively worn then check for burrs or damage on the shaft grooves. If necessary remove burrs with a fine grade abrasion paper and oil.

2 Remove the stake nut **1A** as follows.

- **a** Carefully prise away the staked area of the nut.
- **b** Clamp the holding fixture (service tool 892/01065) in the jaws of a vice as shown at **A**.
- **c** Locate the clutch assembly into the holding fixture.
- **d** Undo the nut using the adaptor spanner (service tool 892/01064) and a 1/2” square drive socket wrench as shown at **B**.

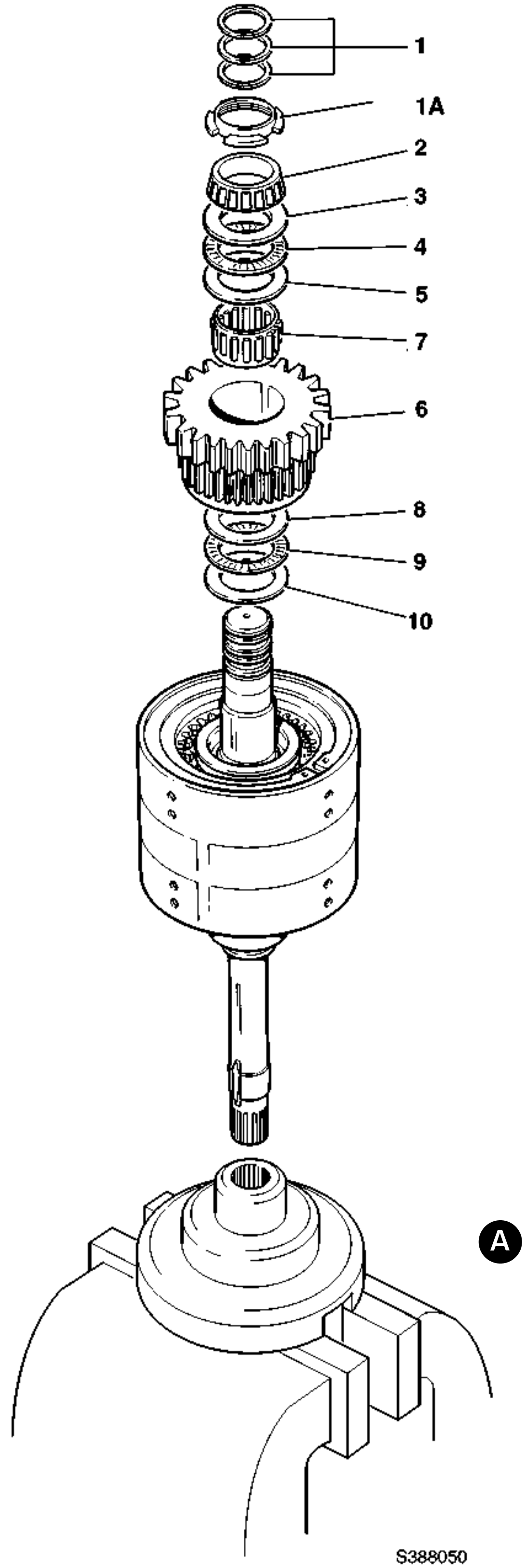
Note: The nut must be discarded - DO NOT re-use.

3 Turn the assembly over and knock the clutch shaft on a wooden block to loosen the clutch end bearing **2**. Remove the bearing using pullers.

4 Remove the thick thrust washer **3,** thrust bearing **4** and thin thrust washer **5**.

5 Withdraw the gear and splined hub assembly **6** and the needle roller bearing **7**.

6 Remove the thin thrust washer **8**, thrust bearing **9** and thick thrust washer **10**.



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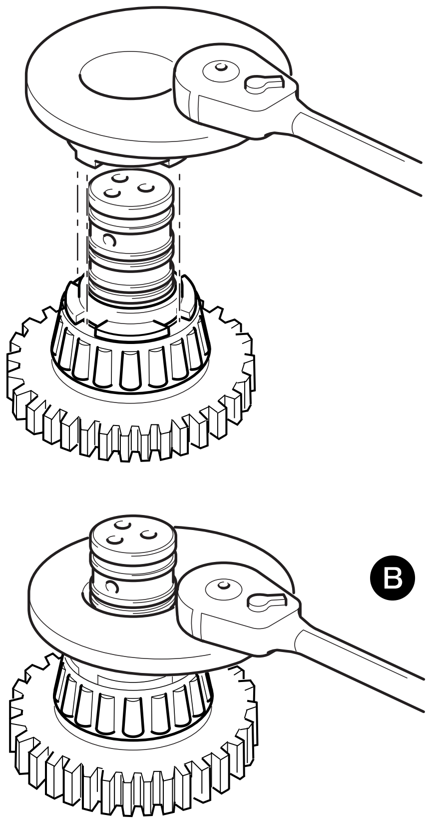

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Dismantling (Cont'd)

7 Remove the clutch friction/counter plate retaining circlip **11**.

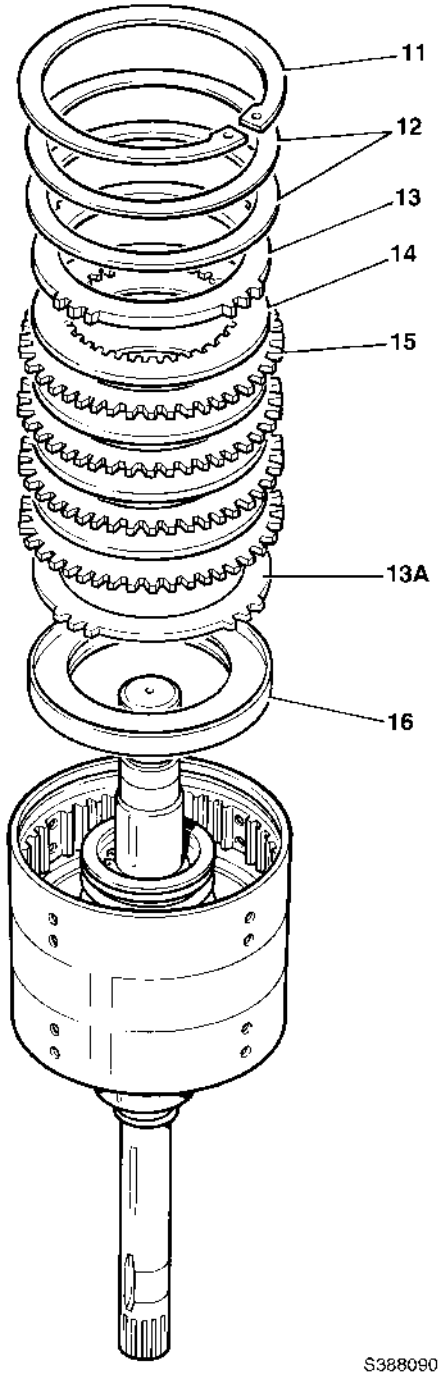
8 Remove the thick pressure end plate (6mm thick) **13**.

Note: If the reverser unit has been previously dismantled, shims **12** may also be fitted.

9 Remove clutch friction plates **14** (4 off) and counter plates **15** (4 off). Keep plates together in sets, DO NOT mix with those from other clutches.

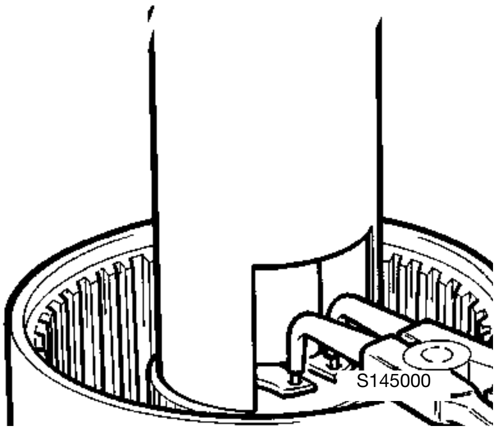
10 Remove the thin pressure plate (4mm thick) **13A**.

11 Remove the disc spring assembly **16**.



Dismantling (Cont'd)

12 Position clutch assembly in a suitable press to compress the piston spring then remove circlip **17**.



13 Lift off spring retaining plate **18.**

14 Remove spring **19** and oil baffle plate **20**.

15 Turn the assembly over and knock the clutch shaft on a wooden block to loosen the piston **21**.

Note: If the piston does not loosen, hand pump air down the shaft oil inlet hole.

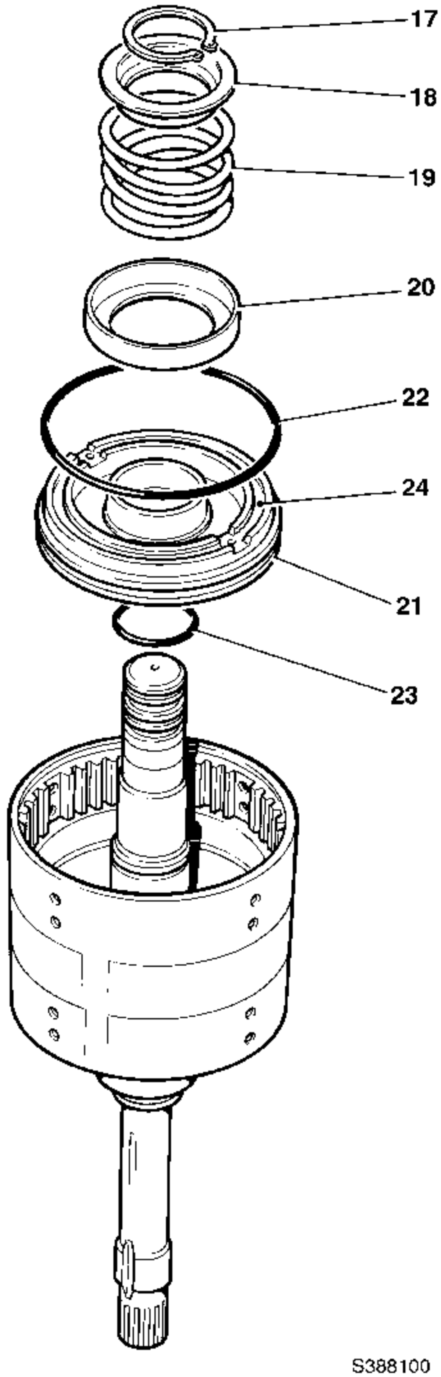
16 Remove the piston **21.** Remove and discard the piston 'O' ring **22** and shaft 'O' ring **23.**

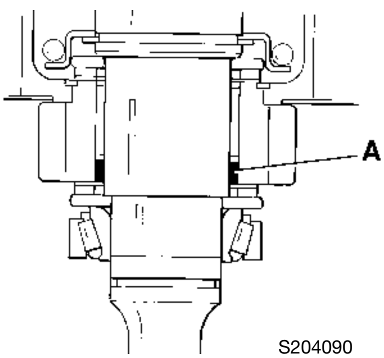
17 Make sure that the piston liner **24** is secure and is a tight fit on the piston.

18 Dismantle the opposite clutch assembly (torque converter end) by repeating steps 1 to 17 and observing the following notes.

Note: The clutch shaft has only one piston ring seal **1** fitted at this end.

Note: Spacer **A** is fitted on the clutch shaft after the needle roller bearing **7**. The spacer may be fitted at either end of the needle roller bearing.





Assembly

The assembly procedure is the reverse of the dismantling procedure.

Make sure all components are thoroughly clean prior to assembly. Renew all 'O' rings.

1 Lubricate the piston **21** with hydraulic oil and press fully into bore of clutch housing.

2 Fit oil baffle **20**, spring **19** and spring retaining plate **18.**

3 Compress spring and fit circlip **17.**

4 Fit the disc spring assembly **16** and the thin pressure plate (4mm thick) **13A.**

5 Fit counter plates **15** and friction plates **14** alternately, starting with a counter plate.

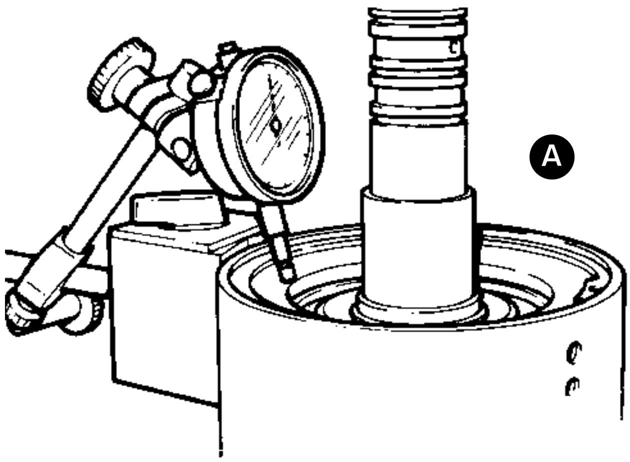
6 Fit the thick pressure end plate (6mm thick) **13** and clutch friction/counter plate retaining circlip **11**.

7 Using a dial test indicator as shown at **A**, measure the end float of the pressure end plate **13**, which should be 2.0 to 3.3 mm (0.079 to 0.130 in). If the float is above 3.3mm (0.130 in), fit shim **12** between the retaining circlip and pressure end plate to bring end float within tolerance. If the float is below 2.0 mm (0.079 in), remove the thin pressure plate (4mm thick) **17** at piston end and replace with a counter plate **13**, then shim as necessary to bring end float within tolerance.

8 Fit thrust washers **10** and **8** and thrust bearing **9**.

9 Carefully align teeth of clutch plates using a thin rod or screwdriver. Fit gear and splined hub assembly **6**.

10 Fit needle roller bearing **7**, thrust washers **5** and **3** and thrust bearing **4.**



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11 Pack the clutch end bearing with JCB MPL Grease and press the bearing onto clutch shaft.

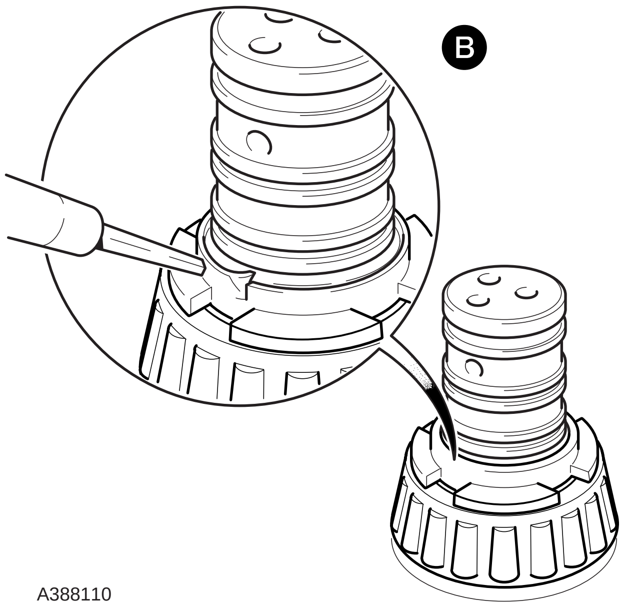
12 Fit a new stake nut **1A** and torque tighten to 200 Nm (147.5 lbf ft).

Note: To tighten the nut locate the clutch assembly into the holding fixture (service tool 892/01065) as shown in dismantling and use the adaptor spanner (service tool 892/01064) and a 1/2” square drive torque wrench.

13 Re-stake the nut using a square ended staking tool as shown at **B**.

14 Fit piston ring seals.

15 Assemble the opposite clutch assembly (torque converter end) by repeating steps 1 to 14.



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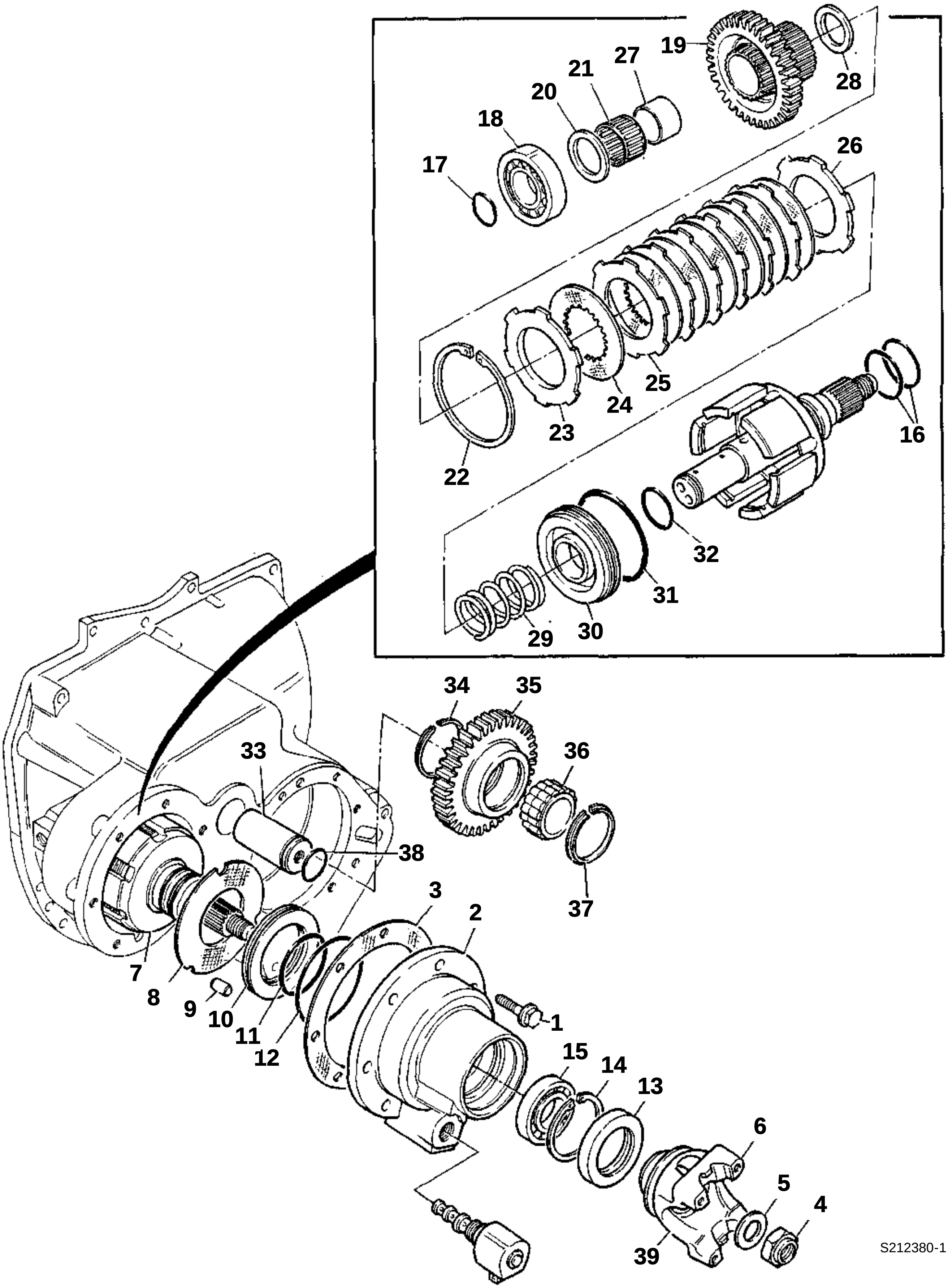
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Power Take Off Clutch

Removal and Replacement

Removal

Note: If the PTO clutch is to be dismantled, the drive yoke stake nut **4** should be loosened before the clutch is removed from the gearbox.

Disconnect the hydraulic pipe connection from the PTO housing. Plug the exposed connections to prevent ingress of dirt.

Loosen and remove the 8 bolts **1** which secure the PTO housing **2** to the gearbox.

Carefully lift the PTO clutch from the gearbox. Remove and discard gasket **3**.

Replacement

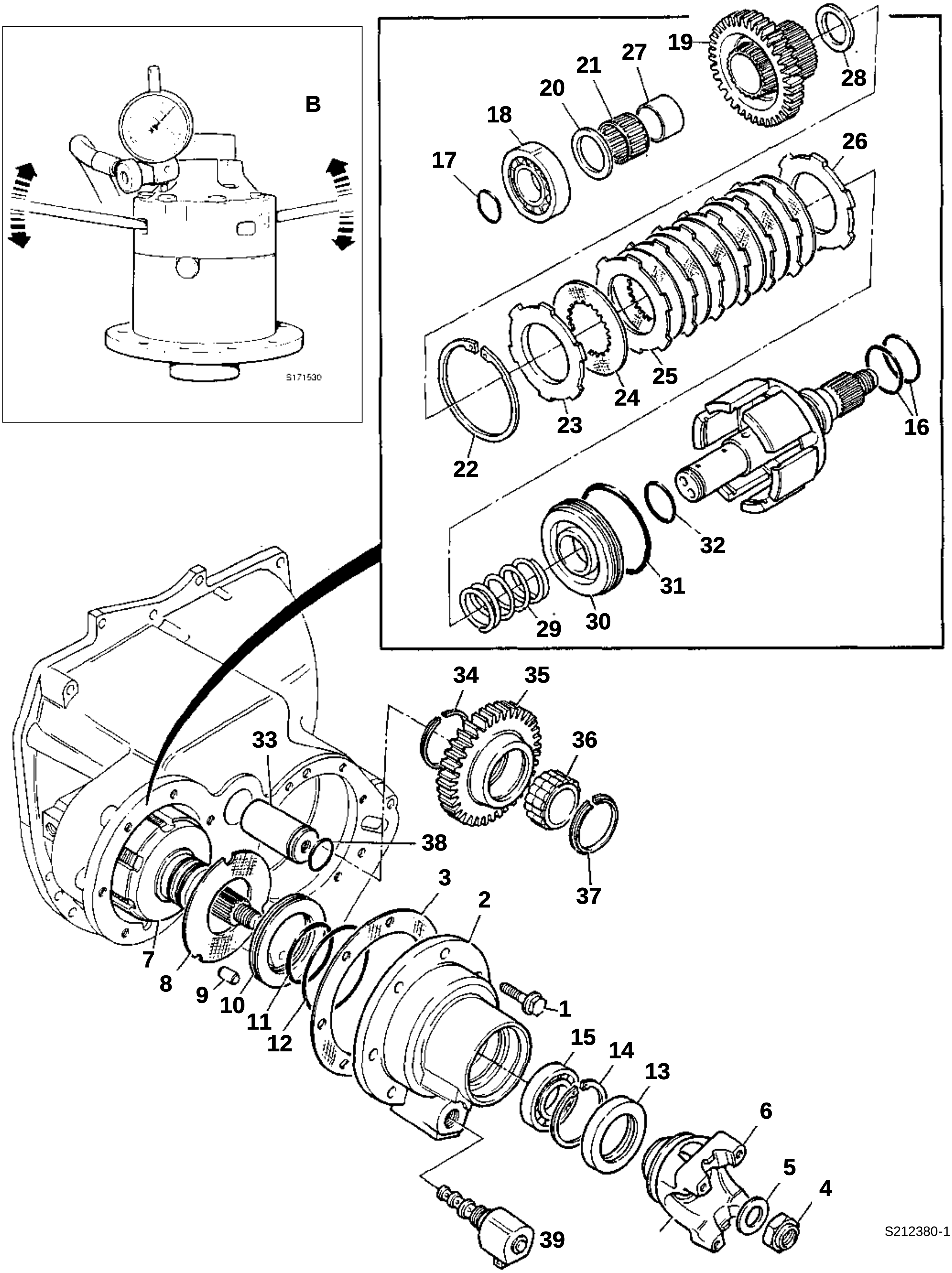
Replacement is the reverse of the removal procedure.

Torque tighten bolts **1**.

When fitting stake nut **4**, torque tighten as indicated then split the nut sleeve axially using a square ended staking tool. (This operation may be easier performed after the clutch has been replaced in the gearbox.)

Torque Settings

Item			
1	56 Nm	41 lbf ft	5.7 kgf m
4	350 Nm	258 lbf ft	35.7 kgf m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S212380-1

Power Take Off Clutch

Dismantling and Assembly

Idler Assembly

The idler assembly (items **33** - **37**) can be dismantled after the PTO clutch has been removed and must be assembled before the PTO is replaced. Withdraw shaft **33** using an impulse extractor screwed into the M12 tapped hole in the end of the shaft, then remove the remaining components via the PTO cavity. Assembly is the reverse of the dismantling sequence.

Dismantling

Follow the numerical sequence on the illustration to dismantle the unit, noting the points listed below.

Use suitable screws, inserted into the threaded holes provided, to remove the brake piston **10**.

Dowels **9** (3 off) should be removed if they are loose, to prevent losing them.

Bearing **18** will either remain on the clutch shaft or in its housing in the gearbox when the clutch is removed.

Dismantling of the clutch assembly **7** will be easier if it is secured in a soft-jawed vice, coupling end lowermost.

Thrust washer **28** and ring **27** should be removed using a bearing puller applied to thrust washer **28**. Discard ring **27**. Take care not to damage the clutch housing and the oil holes in the end of the shaft when using the puller.

Note: Do not attempt to lever off these components. Always use the correct tool.

The clutch pack comprises alternate friction plates **24** and counter plates **25**, beginning and ending with a friction plate. The pack is sandwiched between two spacers **23** and **26**, and secured by circlip **22**. Retain these items as a set for assembly.

Note that the clutch housing cannot be removed from the shaft.

Discard all seals and O rings.

Inspection

Thoroughly clean all components. Ensure that all oil ways are clear.

Inspect generally for damage. Check for scoring inside the piston housing and at the oil feed end of the shaft. Polish out if necessary.

Check the operation of the non-return valve located in piston **30**.

Check the clutch pack for damage and excessive wear. Replace the complete set of friction and counter plates if necessary. Do not mix plates from different clutch packs.

Check the condition of brake disc **8**. Renew if necessary.

Assembly

Assembly is basically the reverse of the dismantling sequence, but please note the following.

Use new seals and O rings. Lightly oil components before installing them.

Pack the cavity between the lips of seal **13** with grease before assembly.

Thrust washer **28** should be installed using a bearing press, ensuring that the plate is pressed squarely onto its shoulder on the shaft. Ring **27** should similarly be installed using a bearing press.

When installing the clutch pack, ensure that the friction/counter plates are installed in the correct sequence, see **Dismantling**. Note that there are seven friction plates **24**, and six counter plates **25**. Use the pinion assembly **19** to align the inner teeth of the friction plates.

Lightly oil bearings **15**, **18** and **21** before installing and rotate them during setting.

After assembly, and using an airline, check that the clutch operates smoothly and that there is endfloat.

Measure the clutch pack end float using two screwdrivers as shown at **B**. The clutch pack endfloat should be 1.3 - 3.6 mm. If incorrect, check for damage, correct assembly and that the correct number of clutch plates have been installed. Note that shims are not necessary.

Fitting stake nut **4** may be easier performed after the clutch has been replaced in the gearbox, see **Removal and Replacement**.

Torque Settings

Item			
39	47-54 Nm	35-40 lbf ft	4.8-5.5 kgf m

Power Take Off Clutch

Dismantling and Assembly (cont'd)

Brake Operation

With the assembly mounted on the gearbox, check the operation of the clutch brake as follows:

With no electrical power or pressure connected, check that the coupling **6** is free to rotate.

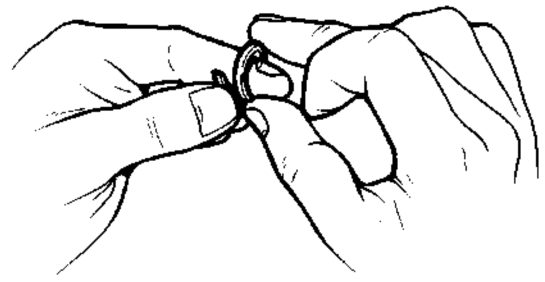
With air pressure connected to the solenoid valve **39** and the solenoid de-energised, check that the coupling cannot be rotated (i.e. brake on).

With air pressure connected and the solenoid energised, check that the coupling can be rotated back and forth as far as the gear backlash allows (i.e. brake off).

Note: The solenoid can be damaged if it is connected the wrong way round. Ensure correct polarity before applying power.

Piston Ring Seals - Fitting Procedure

1 Wind the PTFE piston ring seal around your finger as shown, so that the seal forms a 'coil'.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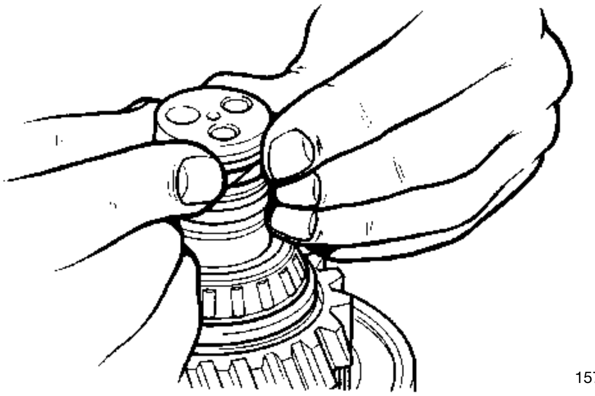
2 Smear the seal with grease and then fit the seal to the shaft.

Make sure that the seal sits below or flush with the outer diameter of the shaft. If necessary, use finger pressure as shown to make the seal flush with the shaft.

CAUTION: If the seal is not set below or flush with the outer diameter of the shaft, then the seal will 'cut' when the shaft is fitted to its mating component.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Removal and Replacement

The torque converter must be removed together with the syncro shuttle gearbox, refer to **Syncro Shuttle Gearbox - Removal and Replacement**.

Replacement

1 Ensure that flywheel face, drive plate, and hardware are clean and free from burrs or other surface imperfections.

2 Offer drive plate **1** to the torque converter.

3 Place the torque converter alignment tool **A** over the torque converter spigot, make sure that the tool locates in two of the converter bolt holes as shown. It is important to note that the converter drive tube must be protected against damage or contamination at all times.

4 Fit four of the M10 flanged bolts **2** and torque tighten to 84 Nm (62 lbf ft). Remove the alignment tool and fit the remaining two retaining bolts **2**.

5 Offer the torque converter and drive plate assembly to the flywheel, bolt the drive plate to the flywheel (use only 3 bolts). Check the converter run-out as shown at **B**, which should not exceed 0.38mm (0.015 in.).

Note: In the unlikely event that the run-out exceeds 0.38 mm (0.015 in.), remove the converter and check the spigot for burrs, remove the drive plate and rotate it 180° on the torque converter, repeat steps **3** to **5**.

6 Remove the torque converter and drive plate assembly from the flywheel.

7 Install the torque converter with its drive plate assembly onto the transmission input shaft, make sure that the dogs on the converter pump drive shaft engage with the recesses in the pump, also take care not to damage the oil seal.

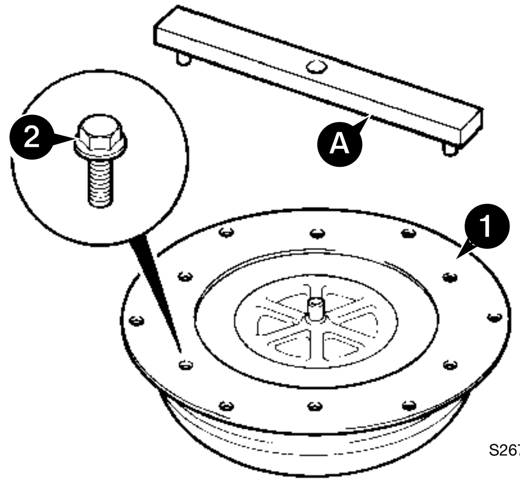
8 Rotate the engine flywheel so that one bolt hole is in a six O' clock position.

9 Rotate the torque converter and drive plate assembly so that one bolt hole is in a six O' clock position.

10 Install the transmission/torque converter assembly to the engine.

11 Remove the access plate from the bottom of the engine flywheel housing and through the access hole fit and hand tighten one M8 flanged bolt (item **3**) in the six 'O' clock position

12 Rotate the flywheel until the next bolt hole is accessible, fit and hand tighten the next bolt **3**. Repeat the operation until all bolts are fitted. Finally torque tighten bolts **3** to 44 Nm (32 lbf ft), rotating the flywheel each time to align bolts **3** with access hole. Refit access plate.



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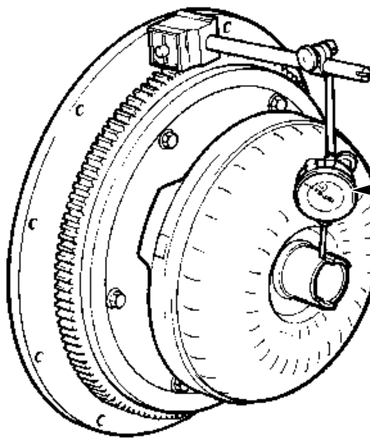

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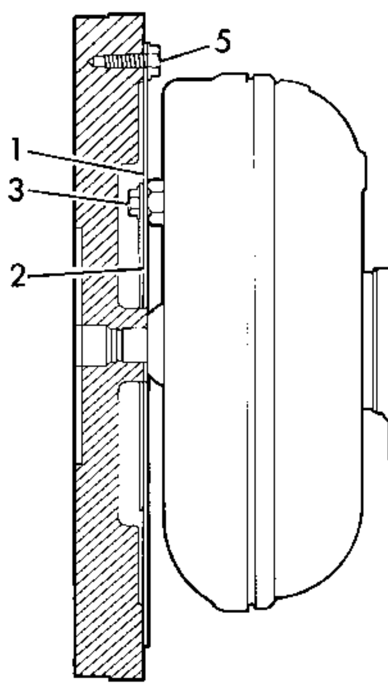

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Contents **Page No.**

System Type	Hydraulic service brakes in rear axle only, operated from seperate pedals. No servo assistance. Independant cable operated parking brake on output to front wheels.
Service Brakes	
Type	JCB Oil-Immersed Multi-Plate Discs
Actuation	Hydraulic
Location	Rear Axle Centre Casing (2 brake packs)
Friction Plates (5 per brake pack)	
Outside Diameter	165 mm (6.496 in) nominal
Inside Diameter	103 mm (4.055 in) nominal
Hydraulic Piston Diameter	166 mm (6.535 in)
Master Cylinder	
Number of Cylinders	2
Type	Compensated master cylinder
Piston Diameter (each)	22.22 mm (0.875 in)
Parking Brake	
Type	Disc Brake, Manually Adjusted Caliper
Actuation	Cable operated
Location	Mounted on transmission output to the front wheels
Disc Diameter	279.4 mm (11 in)

Note: Because the service brakes are located in the rear axle, instructions for dismantling and assembly are shown in Section F **Rear Axle Brakes**.

Compensating Master Cylinder

Description

Compensating master cylinders overcome the problem of unequal wear between the right and left brake. The units incorporate both master cylinder and compensating valve.

Each brake has its own master cylinder **A**, **A1**, brake pedals **B**, **B1**, and associated pipework. Both master cylinders have one common reservoir **C**.

Pedals Locked - Normal Operation
When the brake pedals are pushed down (the brake pedals are mechanically locked together), rod **D** pushes the plunger **E** down the bore of the master cylinder. Pressurised oil acting on centre valve seal **F** via valve stem **G** causes the seal to close off the reservoir supply port. As the plunger continues to move down the bore, pressurised oil flows to the brake pack **H** via service port **J** and the associated pipework.

Master cylinder **A1** operates in the same way to feed brake pack **H1**.

With valve stem **G** at maximum travel, further movement of plunger **E** causes valve **K** to lift off its seat. Both master cylinders are interconnected via bridge pipe **M**, therefore hydraulic pressure in both cylinders will be equal.

If the brake packs **H** and **H1** have worn equally, then the amount of oil displacement between cylinders will be minimal and the brakes will be applied evenly.

Pedals Locked - Compensating Operation
When the brake pedals are pushed down (the brake pedals are mechanically locked together), actuation of the brake packs **H** and **H1** is as described in Pedals Locked - Normal Operation. If however, the brakes have not worn equally, then the amount of fluid displaced from each master cylinder will vary and some form of compensation is required.

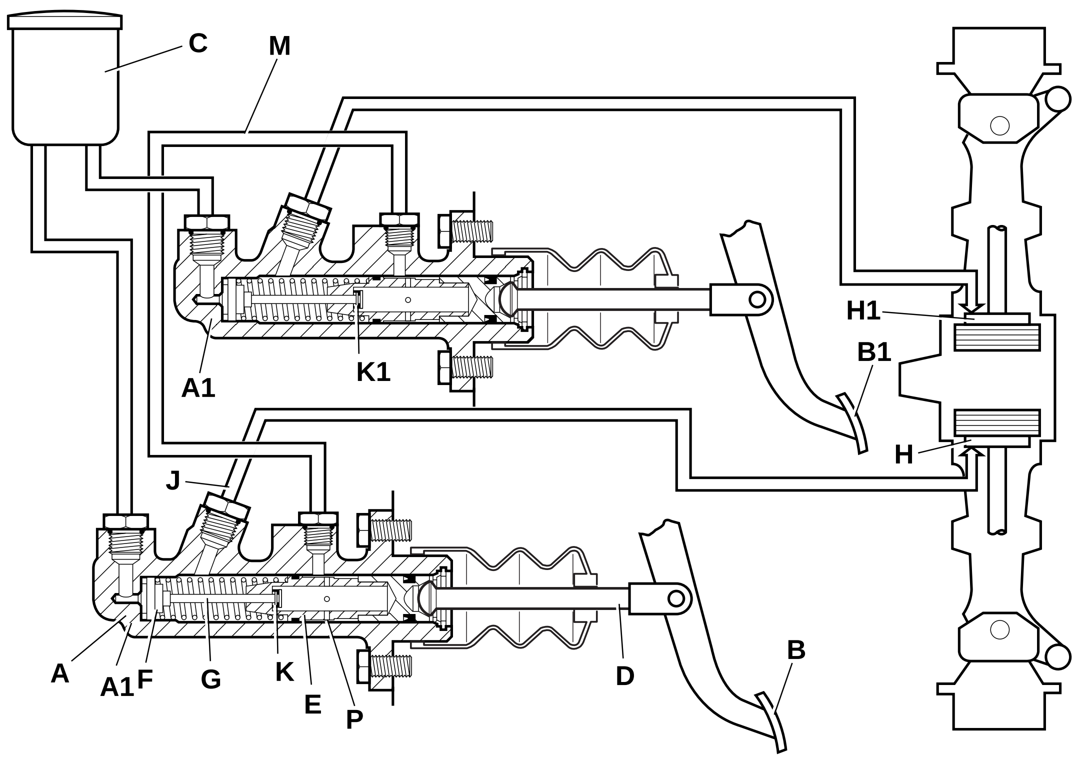
Pedal application moves plungers **E** down the bores of master cylinders **A** and **A1.** Linings of brake **H** are brought into contact before the linings of brake **H1** because they have not worn as severely.

If further displacement took place at the linings, brake **H** would be applied before brake **H1**. Therefore master cylinder **A** begins to compensate for master cylinder **A1**.

Fluid is displaced from **A** to **A1** via bridge pipe **M** until the pressures are equalised. In this condition both compensating valves are open and both brakes are applied evenly.

Pedals Unlocked - Normal Operation
When a single brake pedal is pushed down, rod **D** pushes the plunger **E** down the bore of the master cylinder. Pressurised oil acting on centre valve seal **F** via valve stem **G** causes the seal to close off the reservoir supply port. As the plunger continues to move down the bore, pressurised oil flows to the brake pack **H** via service port **J** and associated pipework, thus braking one wheel only.

With valve stem **G** at maximum travel, further movement of plunger **E** causes valve **K** to lift off its seat. Fluid is displaced through drillings **P** from the active cylinder **A** via bridge pipe **M** to passive cylinder **A1**. Valve **K1** in the passive cylinder is held on its seat by the displaced pressurised fluid.



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Brake System

Note: The brakes generate a high temperature when operating, this means that the casing will be hot to touch, this condition is normal.

FAULT	POSSIBLE CAUSE	ACTION
A One or both brakes do not apply. (Brake travel not excessive, brakes not pulling to one side).	1 Master cylinder fault.	1 Check master cylinder in single and coupled pedal modes to identify fault area, service as required.
	2 Friction/counter plate distortion.	2 Check friction/counter plates.
B Pedal travel excessive (but not touching floor).	1 Air in hydraulic system.	1 Check fluid reservoir level. Check for fluid/air leaks, rectify as required.
	2 Leak in hydraulic system.	2 Check for fluid loss at master cylinder and brake piston, all pipes and fittings for loose connections. Rectify as required.
	3 Friction/counter plate distortion.	3 Renew friction/counter plates - BOTH sides.
C Applying one brake (pedals unlocked) also partially engages the other brake.	1 Valve stem seal inside (non-active) master cylinder piston not sealing.	1 Renew master cylinder piston.
D Pedal hard to operate.	1 Tightness at pedal pivot.	1 Inspect pedal pivot. Free-off/lubricate.
	2 Fluid contamination/seal damage.	2 Flush system and renew all hydraulic seals.
	3 Misaligned push rod/pedal.	3 Check and rectify as required.
	4 Kinked or crushed brake pipes.	4 Check/renew brake pipework.
E Pedals touch floor under constant pressure - no fluid loss.	1 Master cylinder fault.	1 Check master cylinder in single and coupled pedal modes to identify fault area, service as required.
	2 Friction/counter plate distortion.	2 Renew friction/counter plates - BOTH sides.
	3 Air in hydraulic system.	3 See item B.1.
F Pedals touch floor under constant pressure - and fluid loss.	1 External fluid leaks.	1 Visually check brake circuit for fluid loss, service as required.
	2 Internal fluid leaks.	2 Refer to **Service Procedures - Brake Piston Seal Leakage Test**.
G Pulling to one side when pedals locked together.	1 Compensating feature not working.	1 Inspect master cylinder compensating operation. Check if blockage in bridging pipe. Service as required.

FAULT	POSSIBLE CAUSE	ACTION
G Pulling to one side when pedals locked together (cont'd).	2 Braking system inoperative on one side.	2 Unlatch pedals to test circuits individually.
	3 Friction plates worn beyond limits or distorted on one side.	3 Renew friction/counter plates - BOTH sides.
	4 Badly adjusted push rods.	4 Adjust push rod (1mm minimum).
	5 Annular piston fault (see item J6).	5 See item J6.
H Poor braking (not pulling to one side).	1 Friction plates worn beyond limits or distorted on one side.	1 Renew friction/counter plates - BOTH sides.
	2 Master cylinder fault.	2 Check master cylinder in single and coupled pedal modes to identify fault area, service as required.
	3 Annular piston fault (see item J6).	3 See item J6.
	4 Incorrect/low axle oil.	4 Fill axle with correct type of oil.
J One or both brakes not releasing.	1 Brake pedal spring fault.	1 Fit a new spring.
	2 Master cylinder fault (plunger stuck in bore).	2 Service as required.
	3 Blocked hole in master cylinder reservoir cap.	3 Fit a new reservoir cap.
	4 Brake pedal free travel incorrect.	4 Adjust pedal free travel.
	5 Fluid contamination/seal damage.	5 Flush system and renew hydraulic seals.
	6 Annular brake piston(s) binding in axle.	6.1 Check that correct brake fluid has been used (incorrect fluid could swell the annular brake piston seals). 6.2 Check if annular brake piston seals in good condition. 6.3 Check that annular brake piston rotates freely in its housing with no seals fitted. 6.4 Check that the annular brake piston seal retracts the piston approximately 0.5mm (0.020 in).
	7 Kinked or crushed brake pipes.	7 Check and renew pipes as required.
	8 Friction/counter plates not free on splines and/or dowels.	8 Check friction/counter plates for free movement, replace if required - BOTH sides.

FAULT	POSSIBLE CAUSE	ACTION
K Poor braking when hot.	1 Moisture in system vapourizing when axle is hot.	1 Strip axle and clean annular piston to remove moisture. Remove master cylinders and check for corrosion, service as required. Flush hydraulic brake system.
L Excessive brake noise in operation. **Note:** Due to the metal to metal contact of oil immersed brakes, limited noise can be heard which is consistent with this type of design - this is normal.	1 Deterioration of axle oil or wrong type of axle oil.	1 Change axle oil.
	2 Axle oil loss.	2 Refill axle with correct oil and check for leaks.
	3 Friction plates worn beyond limits.	3 Renew friction/counter plates.
	4 Friction/counter plates in poor condition.	4 Check for distortion or surface pitting and/or roughness of friction/counter plates (annular grooving of counter plates is acceptable).
M Fluid loss when machine standing, for instance - overnight (see note). **Note:** Confirm fault is as indicated by checking that the pedals DO NOT touch floor under constant pressure.	1 Slight cut or nick in the brake piston seal, refer to **Service Procedures - Brake Piston Seal Leakage Test**.	1 Strip axle, replace seal.

Service Brakes

Brake Piston Seal Leakage Test

The following procedure explains how to check if a brake piston seal is severely damaged/perished or if the seal has a small cut or nick. The test must only be done when the axle is COLD.

⚠ WARNING

Before working on the brake system make sure the machine is on level ground and chock all four wheels.
BRAK 1-4

⚠ WARNING

Do not drive the machine with any part of its brake system disconnected. When the following test has been completed reconnect all brake pipes and bleed the brake system using the recommended procedure.
BRAK 2-1

1 Remove and cap brake piston feed pipe **A**.

2 Fill the brake piston housing with JCB Light Hydraulic Fluid.

3 Check for severe piston seal damage:

a Install a hand pump fitted with a 0 - 40 bar (0 - 600 lbf/in^2) pressure gauge to port **B**, as shown at **X.**

Note: The hand pump MUST be filled with JCB Light Hydraulic Fluid. DO NOT exceed 69bar (1000 lbf/in^2).

b Use the hand pump to generate a pressure in the brake piston housing.

c If the pressure falls off rapidly, or if no pressure reading can be obtained, the seal is severely damaged and needs replacing with a new one.

4 Check for small cuts or nicks in the piston seal:

a Install an adapter fitted with a piece of clear tube to the brake piston port **B**, as shown at **Y**.

Note: The tube must be kept vertical during the test, use tape to attach the tube to the side of the machine.

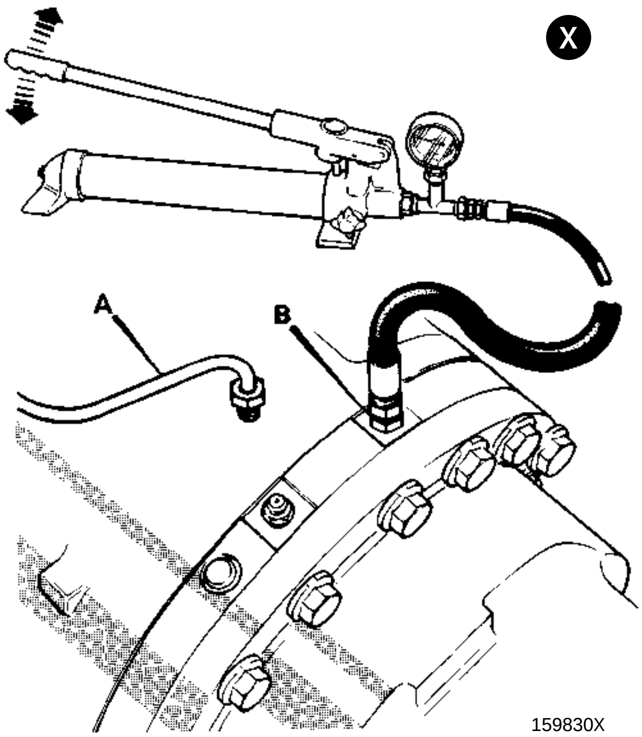
b Fill the tube until approximately three quarters full with JCB Light Hydraulic Fluid

c Using a suitable pen, mark the level line of the brake fluid on the tube, as shown at **C**.

d After approximately 1/2 hour, check if the level has dropped below the original marked line, if it has then check the brake piston seal for slight nicks, cuts or generally for wear.

5 Repeat steps 1 to 4 for the opposite brake piston seal.

6 Reconnect all brake pipes and bleed the brake system. Refer to **Service Brakes - Bleeding**.



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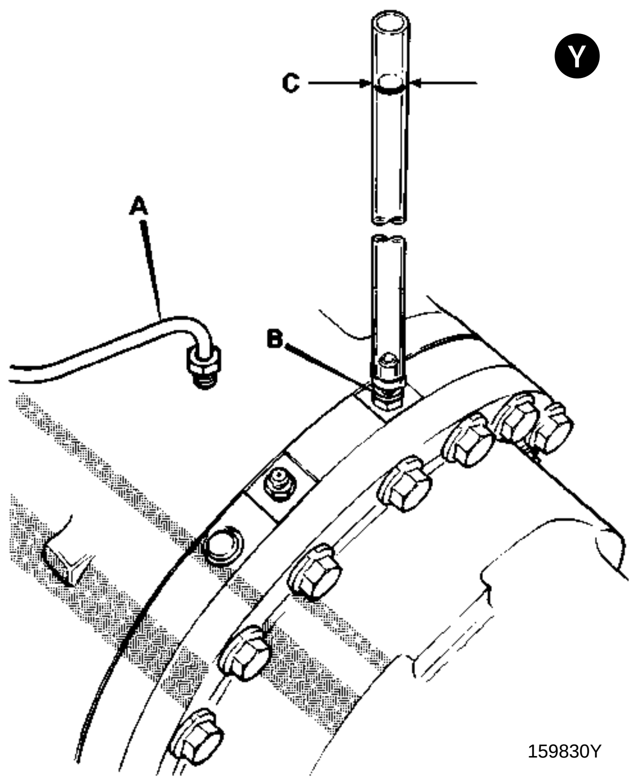

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Parking Brake - Testing

SAFETY NOTICE: Ensure all routine health and safety precautions are observed before operating machines.

⚠ WARNING

Before testing the parking brake make sure the area around the machine is clear of people.

2-2-4-5

1 Enter the machine. Fasten your seat belt and park the machine on a level dry surface.

2 Fully apply the parking brake **1**.

3 Lock the brake pedals together.

4 Start the engine and raise the attachments to the appropriate travelling position.

5 Select fourth gear **2**.

6 Push down hard on foot brake pedal **4**.

7 Select forward drive **5**.

⚠ WARNING

If the machine starts to move during the following test, immediately apply the foot brakes and reduce the engine speed.

2-2-5-1

Test the parking brake as follows:

8 Move the parking brake lever fractionally forward until the warning light **6** is just extinguished.

9 Slowly release the foot brake pedal **4**.

10 If the machine has not moved, use the accelerator pedal to gradually increase the engine speed to 1500 RPM. The machine should not move.

11 Do not do this test for longer than 20 seconds.

12 Reduce the engine speed to idle and select neutral **5**.

13 Return the park brake lever **1** to the fully on position from its partially applied position.

14 Lower attachments and stop the engine.

15 If the machine moved during this test, adjust the parking brake and repeat the test. See **Service Procedures, Parking Brake - Adjustment**.

If you have any queries concerning this test procedure or parking brake adjustment, consult your local JCB distributor.

⚠ WARNING

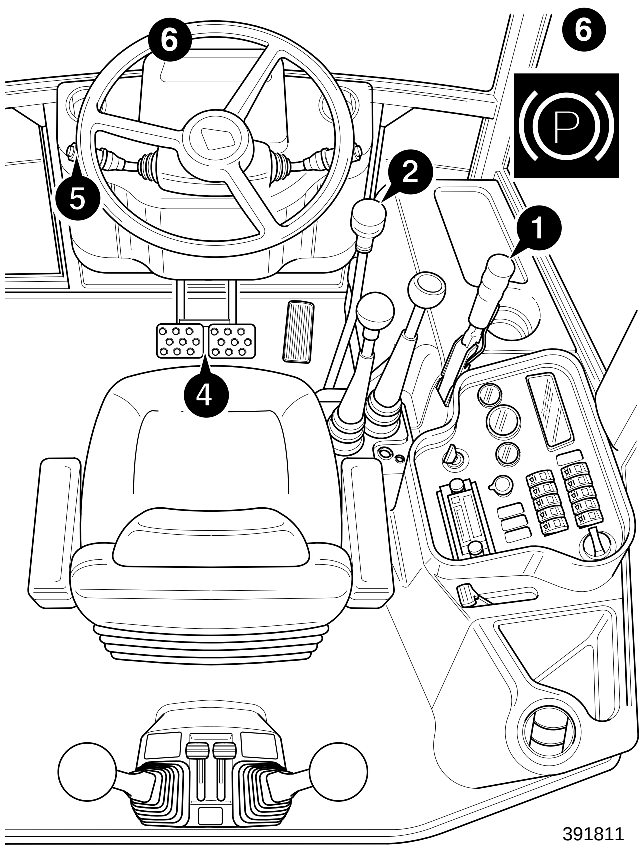
Do not use a machine with a faulty parking brake.

3-2-3-10

⚠ CAUTION

Non approved modifications to axle ratios, machine weight or wheel and tyre sizes may adversely affect the performance of the parking brake.

3-2-3-11



Parking Brake - Adjustment

⚠ CAUTION

The parking brake must not be used to slow the machine from travelling speed, except in an emergency, otherwise the efficiency of the brake will be reduced. Whenever the parking brake has been used in an emergency, always renew both brake pads.

4-2-1-1/2

⚠ WARNING

Before working on the parking brake, make sure that the machine is on level ground. Put chocks each side of all four wheels. Disconnect the battery so that the engine cannot be started. If you do not take these precautions the machine could run over you.

2-3-2-4/1

The parking brake should be fully engaged when the lever is vertical. The parking brake indicator light should light when the brake is engaged with the forward/reverse lever away from neutral (starter switch at IGN).

⚠ WARNING

Over adjustment of the parking brake could result in the parking brake not fully releasing

0011

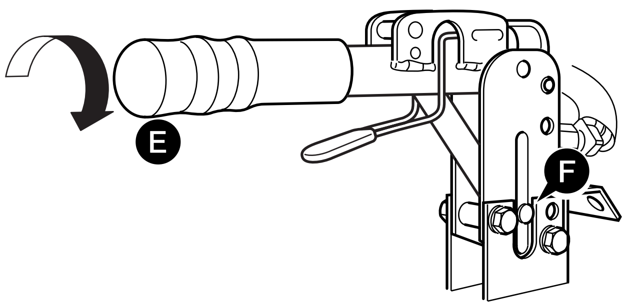
Lever Adjustment

1 Disengage the parking brake (lever horizontal).

2 Turn handle grip **E** clockwise, half a turn.

3 Test the parking brake, refer to **Parking Brake - Testing**.

4 If the brake fails the test, repeat steps **1**, **2** and **3**. If there is no more adjustment and pin **F** is at the end of its travel adjust the cable.



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Cable Adjustment

Adjust the cable at the calliper if there is insufficient adjustment at the parking brake lever.

If there is no adjustment at the lever or the calliper, change the brake pads, refer to **Parking Brake - Renewing the Brake Pads**.

Always renew a worn or damaged cable.

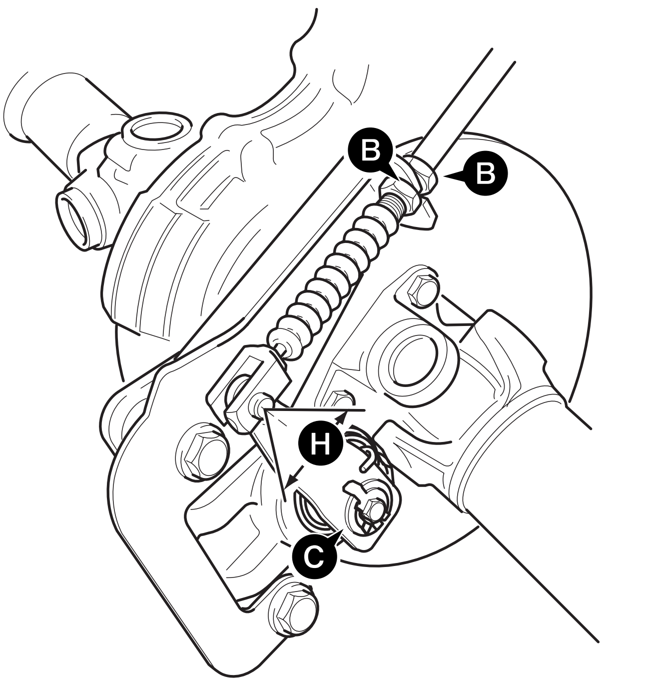
1 Disengage the parking brake (lever horizontal).

2 Turn hand grip **E** anti-clockwise to centre the pin **F** in its slot.

3 Release the two locknuts at **B** and adjust the cable length to give 10 to 15mm (0.40 to 0.60 in) of caliper lever movement at the outer cable fixing hole **H**. The total clearance between the brake pad to brake disc should be 0.5 to 0.75 mm (0.02 to 0.3 in).

4 Make sure there is adequate freedom of movement of operating lever **C** to ensure a positive brake application, and that the lever returns to the rest position when the parking brake is released.

5 Test the parking brake, refer to **Parking Brake - Testing**. Make final adjustments at the park brake lever if the brake fails the test. Refer to **Lever Adjustment**.



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Parking Brake - Renewing the Brake Pads

⚠ WARNING

This is a safety critical installation. Do not attempt to do this procedure unless you are skilled and competent to do so.

Installation and mounting of the parking brake calliper requires tightening of the mounting bolts to a specific torque figure. Do not attempt to do this job unless you have the correct tools available.

0010

⚠ WARNING

Before working on the parking brake, park on level ground and put chocks each side of all four wheels. Stop the engine and disconnect the battery so that the engine cannot be started. If you do not take these precautions the machine could run over you.

BRAK 8-8

⚠ WARNING

Brake pads generate dust which if inhaled, may endanger health. Wash off the calliper before commencing work. Clean hands thoroughly after work.

13-3-1-3

Pad Removal

1 Remove the parking brake calliper from the transmission mounting bracket, refer to **Parking Brake - Calliper Removal and Replacement**.

2 Press carrier side pad **1** into housing **15** and remove. Ensure any residual silicone used for pad retention during assembly is removed.

3 Carefully lever pad **2** from the rotor inside the housing using a flat blade screwdriver. Take care to prevent damage to the plastic clip in the centre of the rotor **9** (there is no need to remove the rotor from the calliper).

Pad Inspection

⚠ WARNING

Oil on the brake disc will reduce brake effectiveness. Keep oil away from the brake disc. Remove any oil from the disc with a suitable solvent. Read and understand the solvent manufacturer's safety instructions. If the pads are oily, new ones must be fitted.

2-3-2-3/3

1 The minimum thickness of the friction material on either pad is 1mm (0.04 in), but it is recommended new pads are fitted as pads worn to this limit may not be able to be adjusted.

2 Check the condition of the disc surface. Renew the disc if badly warped, pitted or worn. For brake disc removal, refer to **Section F, Syncro Shuttle Gearbox - Dismantling and Assembly**

3 Renew the cable if worn or damaged.

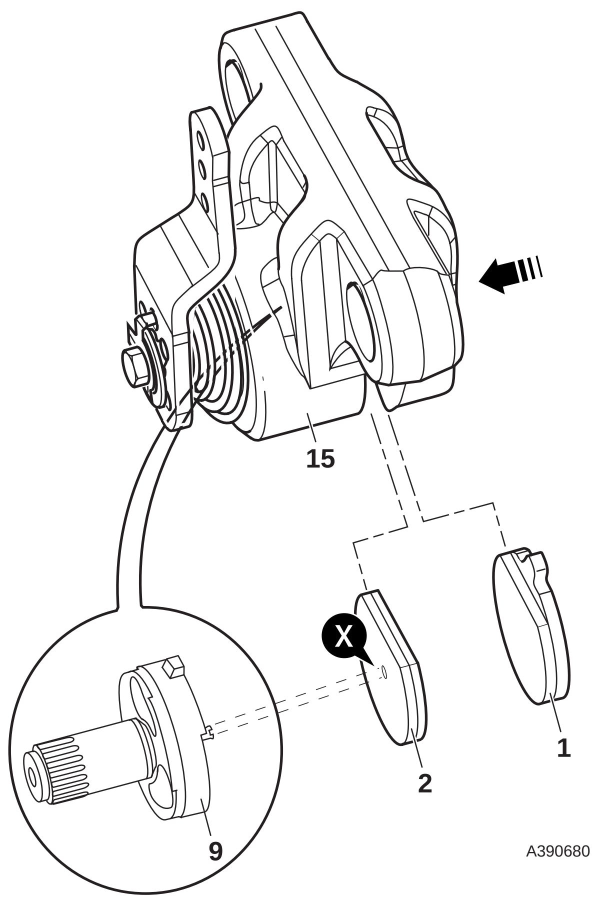
Pad Replacement

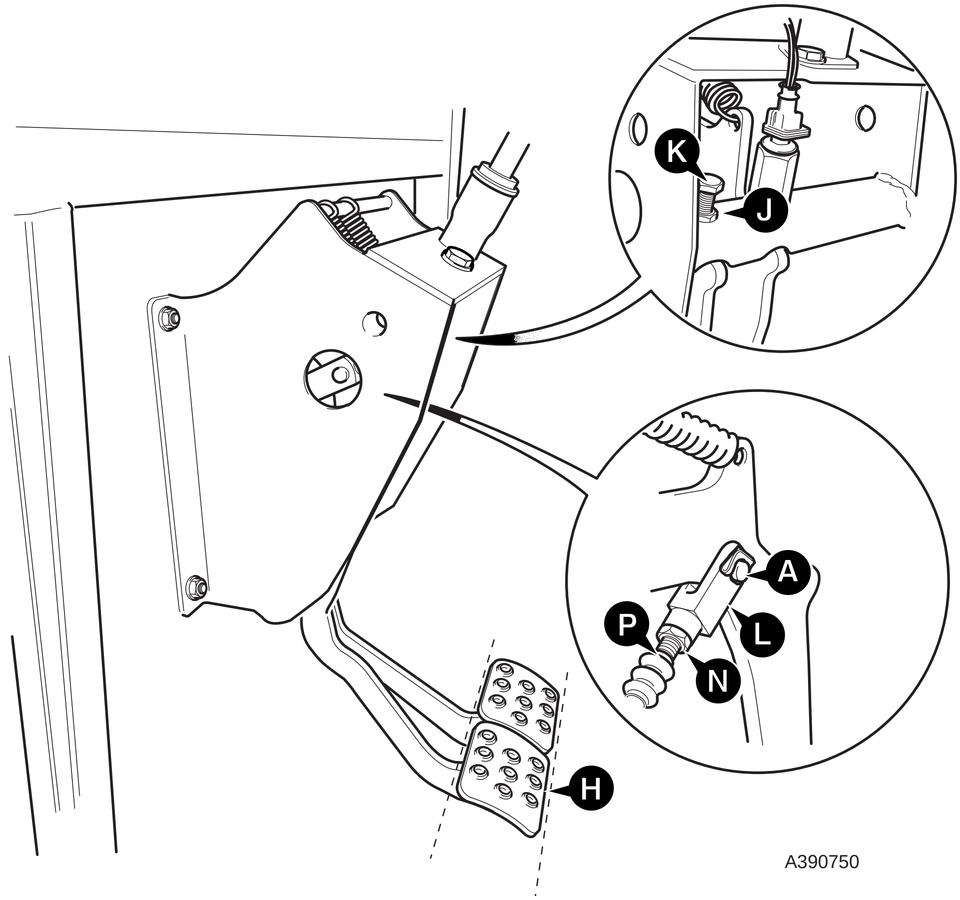
1 Fit the pad **2** to the lever side of the calliper. Position the pad inside housing **15**. Locate the plastic clip in the centre of the rotor **9** into the hole **X**, and press the pad into place.

2 Fit the pad **1** to the carrier sde of the calliper. Add a small amount of silicon sealant to the back outer edge of the backing plate to hold the pad in place within the housing.

3 Replace the calliper, refer to **Parking Brake - Calliper Removal and Replacement**.

Note: If there is insufficient adjustment after fitting new pads change the brake cable.

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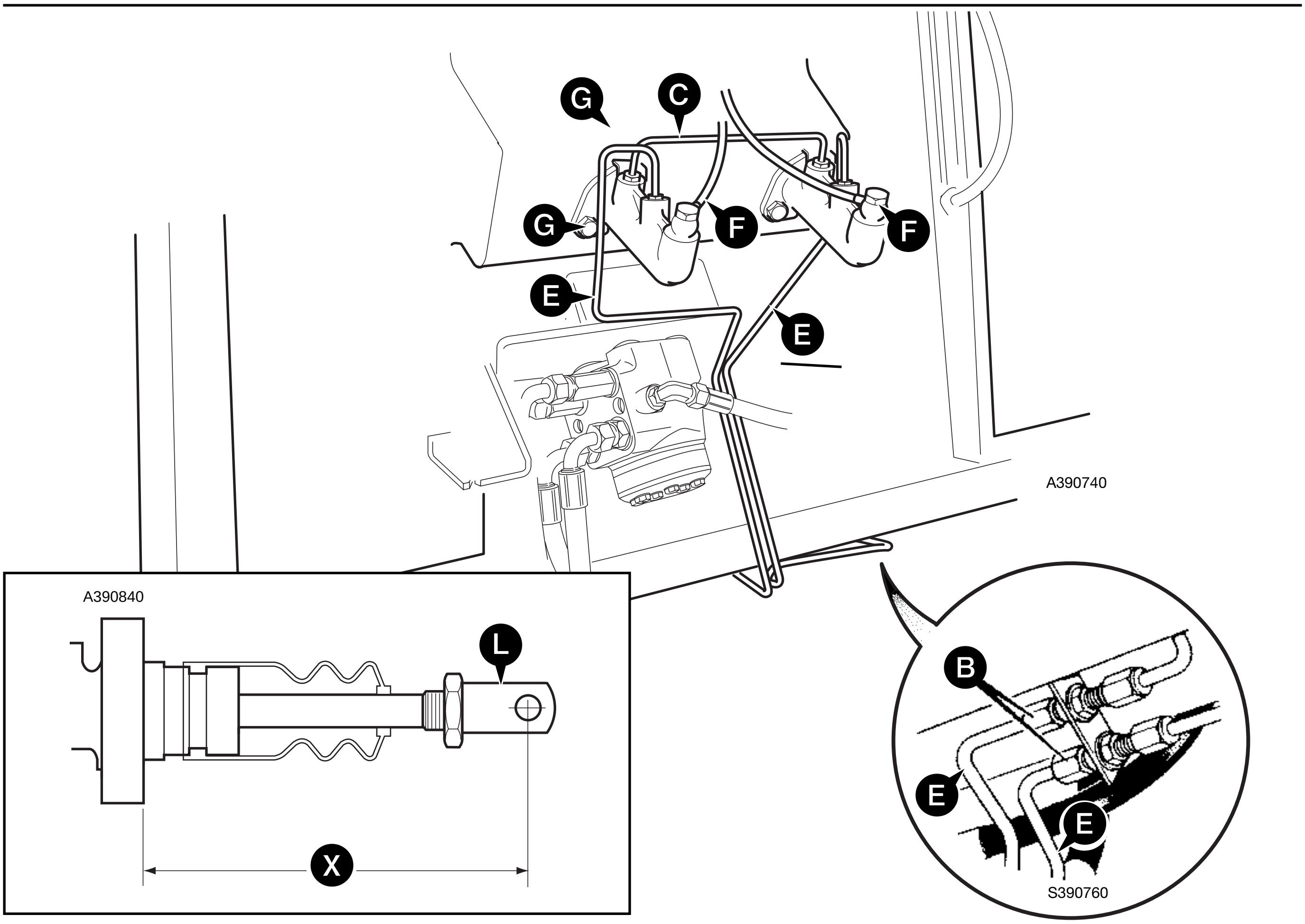
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Removal and Replacement

⚠ WARNING

Before working on the brake system make sure the machine is on level ground and chock all four wheels.
BRAK 1-4

Removal

1 Gain access the the brake pedal box assembly. Remove the steering wheel, column switches and console assembly. See **Section D, Steering Column - Removal** for procedures.

2 Working inside the cab, remove the actuating rod clevis pin **A** at the top of each brake pedal.

3 Working outside the cab, loosen and remove brake pipe unions **B**, plug and cap to prevent loss of fluid and ingress of dirt.

4 Remove the brake pipes from the master cylinders: Master cylinders bridging pipe **C**, axle feed pipes **E** and reservoir supply pipes **F**.

6 Loosen and remove the two master cylinder retaining bolts **G** (both units).

7 Tag the cylinders (left and right hand). Remove the master cylinders.

Replacement

Before replacing the cylinders check the adjustment of the brake pedals as follows:

1 Unlatch the pedals **H** and check to see if they are aligned. Both pedals should be at the same height. If they are not, undo lock nut **J** and turn the stop bolt **K** to correctly align. Tighten the lock nut **J**.

Do not remove or adjust the actuating rod clevis **L**. If the clevis is to be removed (for fitting to a replacement cylinder for example), measure the position of the pin location hole relative to the cylinder body as shown at **X**. Refit the clevis in the same position.

Replacement is a reversal of the removal sequence, but note the following;

Refit the cylinders in their original positions.

When reconnecting the cylinder actuating rods at the brake pedals, ensure that the clevis pins **A** align without moving the rods **P** or brake pedals. If necessary loosen the clevis lock nut **N** and turn the rod **P** until the clevis pin aligns with the brake pedal. Tighten the lock nut **N**.

⚠ WARNING

Use of incorrect fluid will cause serious damage to the seals which could in turn cause brake failure.
BRAK 1-1

2 Fill the brake system with JCB Light Hydraulic Fluid and bleed the system. Refer to **Service Brakes - Bleeding.**

3 On completion bleed the brake system and check the brakes operate correctly. Refer to **Service Brakes - Bleeding.**

4 Latch pedals and check for straight line braking; if satisfactory straight line braking cannot be achieved refer to **Fault Finding**.

Torque Settings

Item	Nm	kgf m	lbf ft
F	30-34	3.0-3.5	22-25

Dismantling and Assembly

Dismantling

1 Remove gaiter **1**. Remove circlip **2** and washer **3**. followed by the actuating rod **4**.

2 Shake the cylinder body **5**, or use compressed air, to eject piston assembly **6**. Take care not to damage the piston assembly, or the bore of the cylinder body **5**.

3 Examine the working surfaces of piston and cylinder. If these are not in perfect condition the master cylinder assembly must be renewed.

Note: The piston assembly **6** can not be dismantled. If it is damaged (including seal **7**), the complete piston/seal assembly must be renewed.

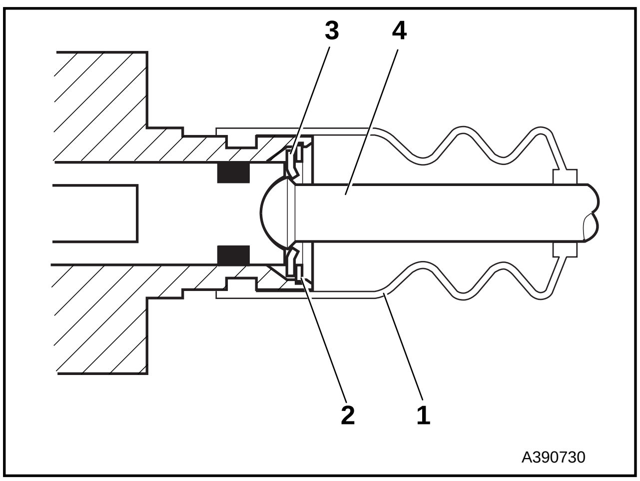
Assembling

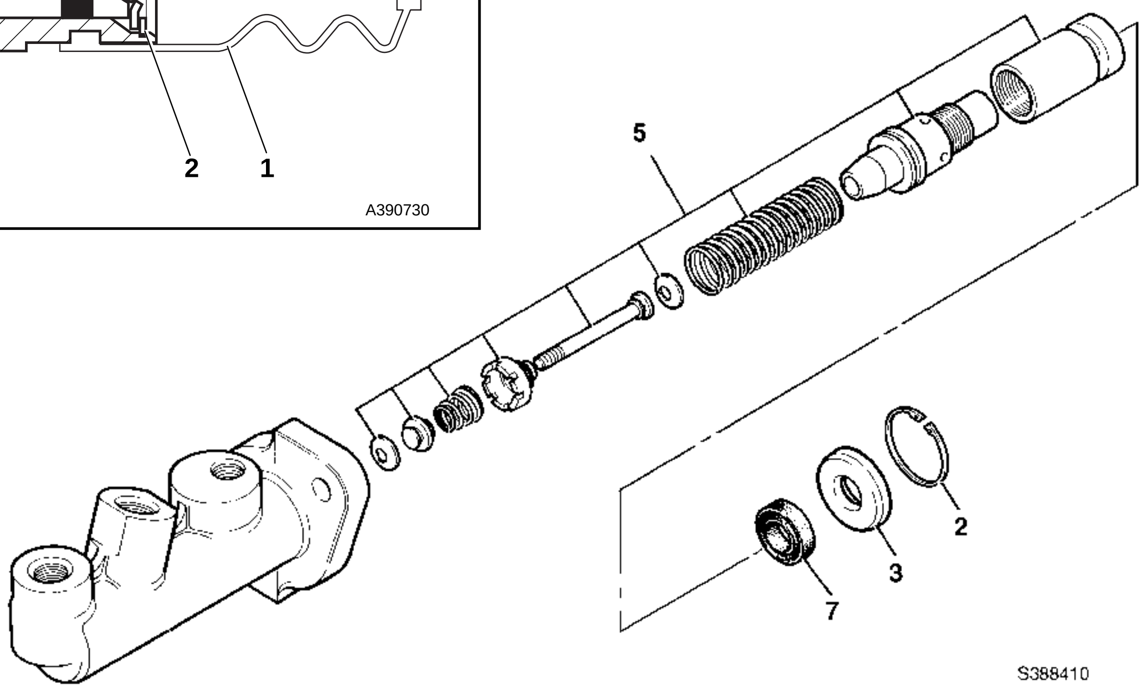
⚠ WARNING

Use of incorrect fluid will cause serious damage to the seals which could in turn cause brake failure.
BRAK 1-1

1 Clean and lubricate all components, with JCB Special Hydraulic Fluid. DO NOT USE CONVENTIONAL BRAKE FLUID OR SERIOUS DAMAGE WILL BE CAUSED.

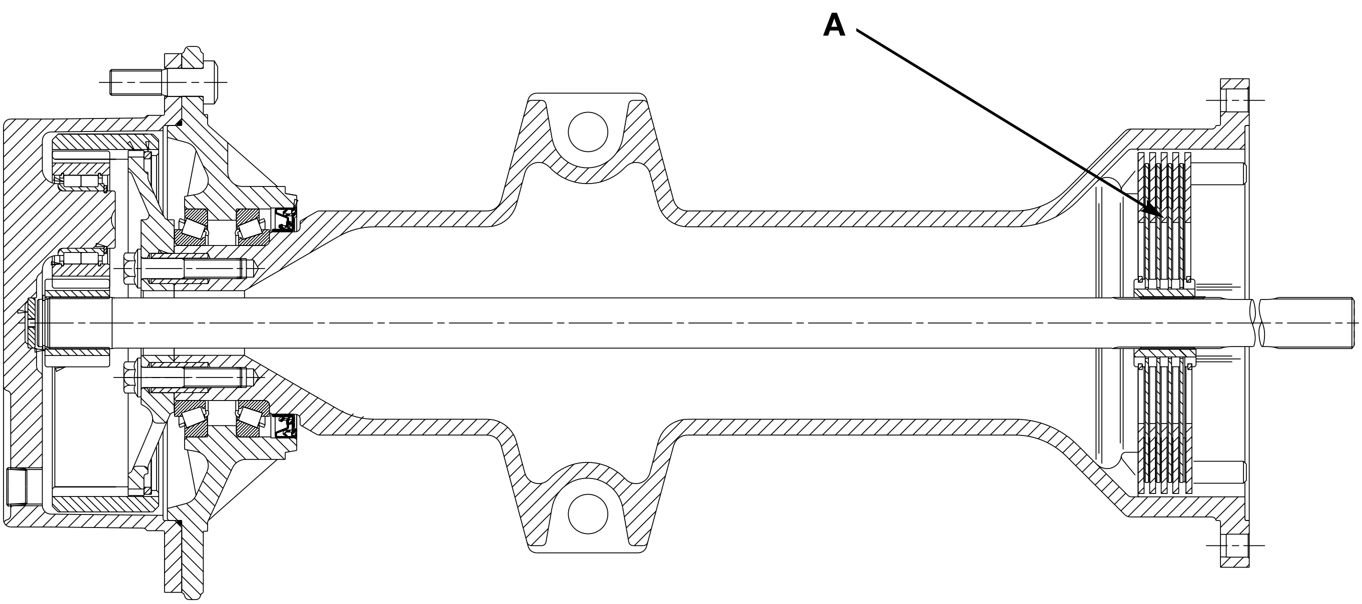
2 Take care not to damage the machined faces of piston assembly **6** when assembling.





Dismantling and Assembly

The service brakes are located in the rear axle, as shown at **A**. Instructions for dismantling and assembly of the brake are described in Section F - **Rear Axle Brakes**.



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Bleeding

⚠ WARNING

Before proceeding with the bleeding procedure it is important to ensure that the parking brake is engaged and that one pair of wheels is blocked on both sides.
BRAK 1-2

⚠ WARNING

Use of incorrect fluid will cause serious damage to the seals which could in turn cause brake failure.
BRAK 1-1

1 Fill the master cylinder reservoir with the correct fluid, refer to Section 3 **Lubricants & Capacities**, and ensure that throughout the bleeding process the level is not allowed to fall below the MINIMUM mark.

2 Unlatch the pedals, and bleed each brake separately as follows:

3 Right Hand Master Cylinder

- **a** Attach a tube to the right hand brake bleed screw **A**, ensuring that the free end of the tube is immersed in fluid contained in a suitable container.
- **b** Open the brake bleed screw and apply full pedal strokes of the right hand brake pedal until all air is expelled.
- **c** Close the brake bleed screw with the pedal fully depressed.

4 Left Hand Master Cylinder

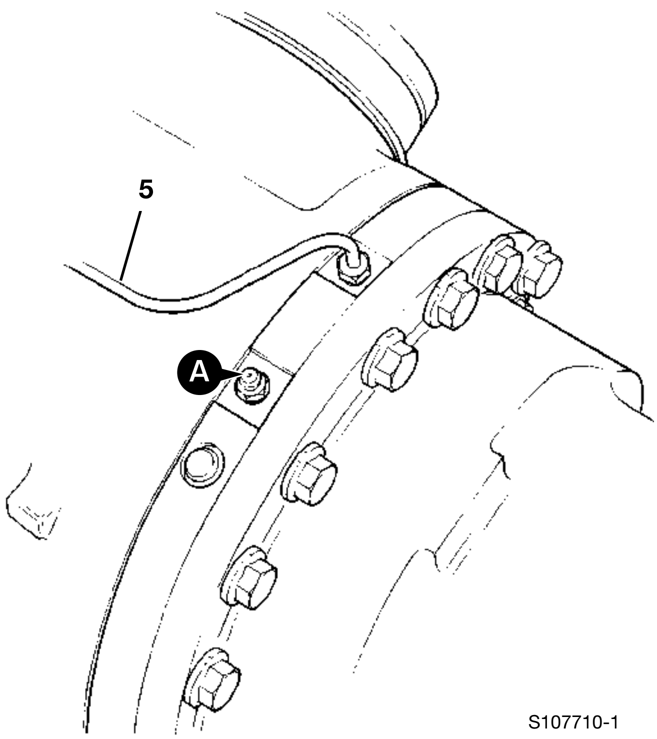
- **a** Repeat procedure as for 'Right Hand Master Cylinder' but use left hand bleed screw and pedal.

5 Bridge Pipe

- **a** Attach a tube to either the left or right hand brake bleed screw, ensuring that the free end of the tube is immersed in fluid contained in a suitable container.
- **b** Make sure that the brake pedals are **locked** together.
- **c** Open the bleed screw and apply full pedal strokes of the brake pedals until all air is expelled.
- **d** Close the bleed screw with the pedals fully depressed.

6 Repeat the procedures as necessary.

7 Top up the reservoir to the full mark.



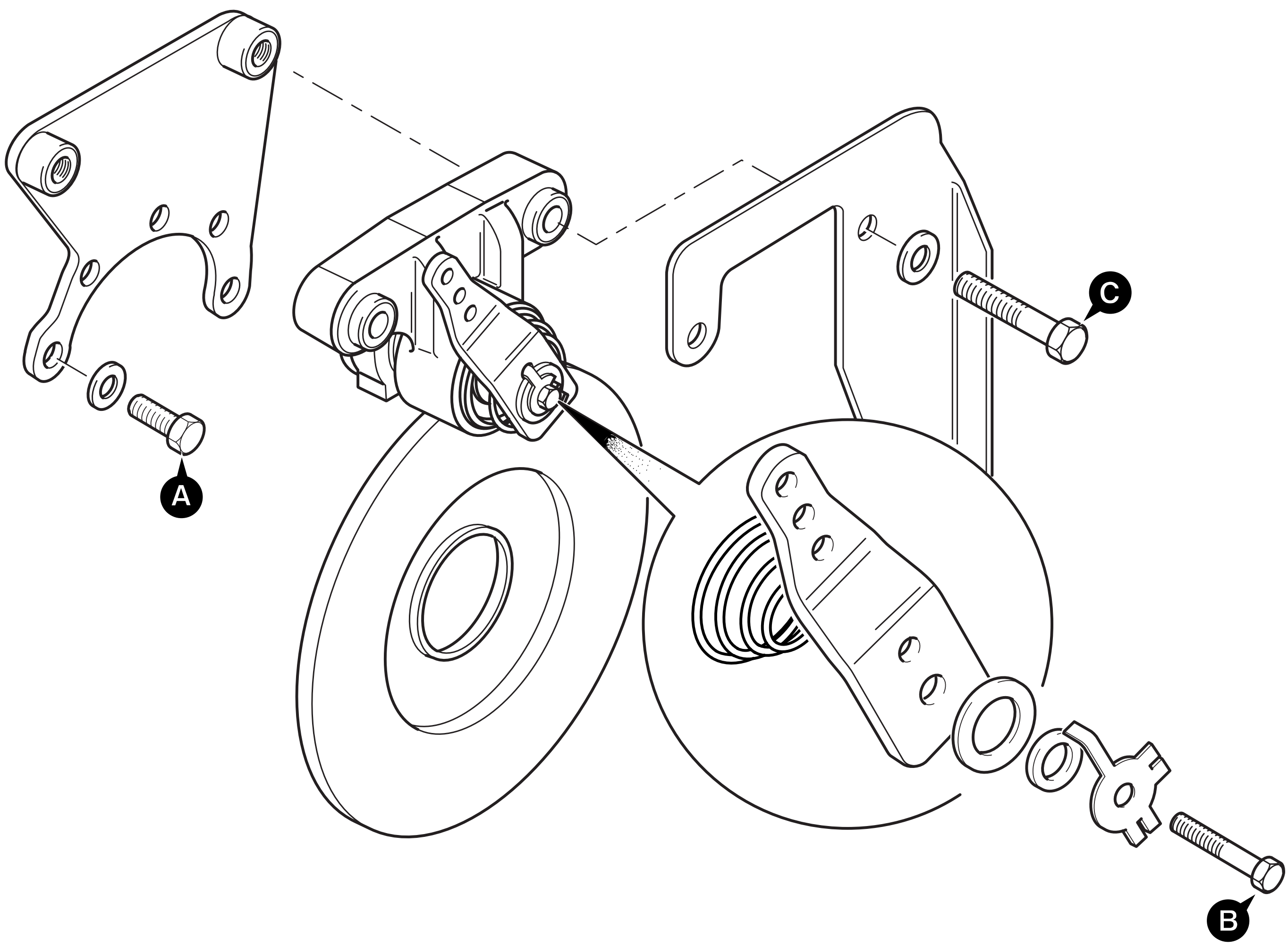
Torque Figures

The illustration shows a typical installation.

Where appropriate, the grade of bolt is indicated in parenthesis eg. (10.9). Refer also to relevant dismantling and assembly procedures.

Torque Settings

Item	Nm	lbf ft	
A	166	122	(12.9)
B	13-15	9-12	
C	255	188	(10.9 Tuflok)



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Calliper Removal and Replacement

⚠ WARNING

This is a safety critical installation. Do not attempt to do this procedure unless you are skilled and competent to do so.

Installation and mounting of the parking brake calliper requires tightening of the mounting bolts to a specific torque figure. Do not attempt to do this job unless you have the correct tools available.

0010

⚠ WARNING

Before working on the parking brake, park on level ground and put chocks each side of all four wheels. Stop the engine and disconnect the battery so that the engine cannot be started. If you do not take these precautions the machine could run over you.

BRAK 8-8

⚠ WARNING

Brake pads generate dust which if inhaled, may endanger health. Wash off the calliper before commencing work. Clean hands thoroughly after work.

13-3-1-3

Removal

1 Release the parking brake lever (lever horizontal).

2 Disconnect clevis **A**, note which of the three holes on the lever is used.

3 Undo locknuts **B** and disconnect the cable from the bracket **D**.

4 Support the calliper and remove the two mounting bolts and hardened washers **C**. Lift the calliper and bracket **D** clear of the brake disc.

Note: Do not remove transmission mounting bracket **F** unless it needs to be renewed.

Replacement

Replacement is the reverse of the removal sequence.

1 Locate the calliper on the brake disc and fit new mounting bolts **C** with hardened washers, torque tighten to 255 Nm (188 lbf ft).

2 Insert cable into bracket **D**, do not tighten locknuts **B** at this stage as the brake will need adjusting.

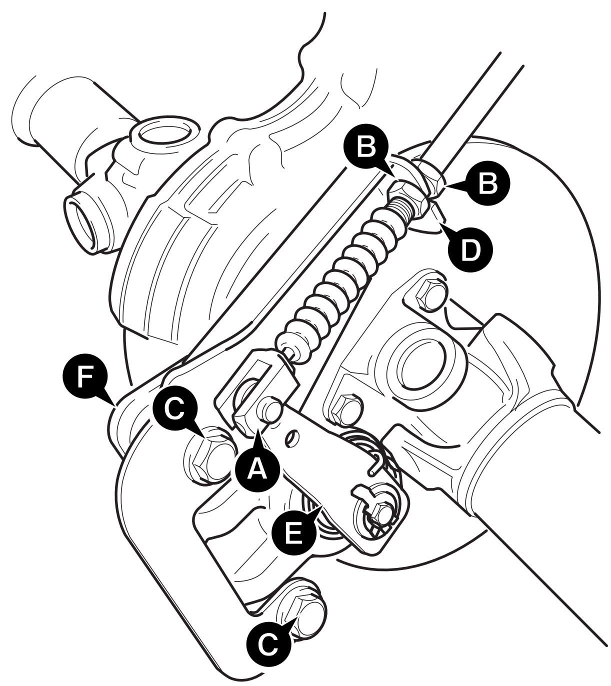
3 Refit the clevis to the top hole in the operating lever **E**.

4 Make sure there is adequate freedom of movement of operating lever **E** to ensure a positive brake application, and that the lever returns to the rest position when the parking brake is released.

5 Adjust the parking brake, see **Service Procedures, Parking Brake Adjustment**. **Never unscrew the clevis A to adjust the cable.**

Torque Settings

Item	Nm	lbf ft
C	255	188



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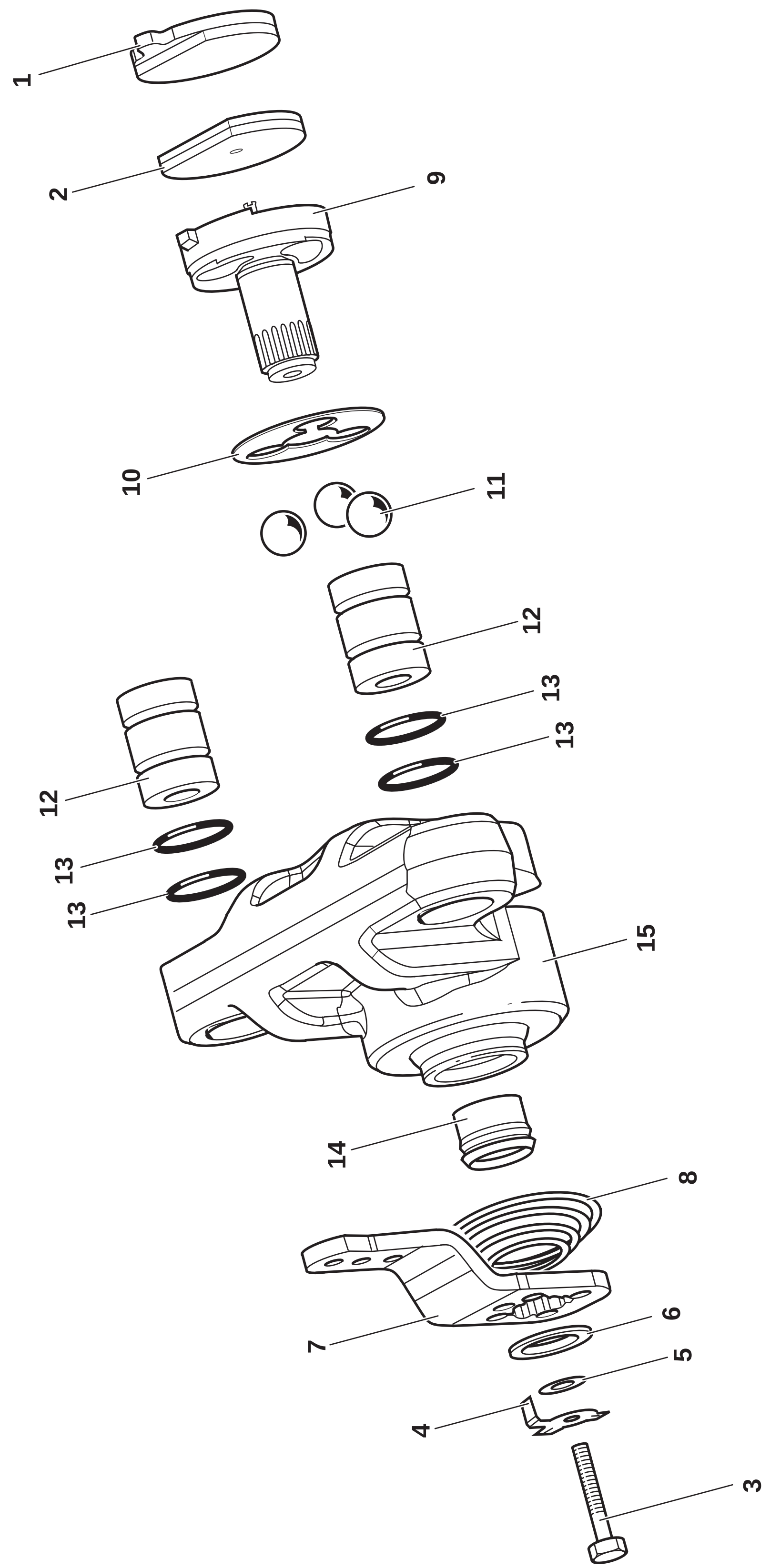

Component Listing:

1	Carrier Side Pad
2	Lever Side Pad
3	Bolt
4	Anti-rotation Clip
5	Washer
6	Washer
7	Lever
8	Spring
9	Rotor
10	Ball Spacer
11	Ball Bearings
12	Mounting Bush
13	O-ring
14	Shaft Seal
15	Housing

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Calliper Dismantling and Assembly

Dismantling

The numerical sequence shown on the illustration on the adjacent page is intended as a guide to dismantling.

⚠ WARNING

This is a safety critical installation. Do not attempt to do this procedure unless you are skilled and competent to do so.

Installation and mounting of the parking brake calliper requires tightening of the mounting bolts to a specific torque figure. Do not attempt to do this job unless you have the correct tools available.

0010

⚠ WARNING

Before working on the parking brake, park on level ground and put chocks each side of all four wheels. Stop the engine and disconnect the battery so that the engine cannot be started. If you do not take these precautions the machine could run over you.

BRAK 8-8

⚠ WARNING

Brake pads generate dust which if inhaled, may endanger health. Wash off the calliper before commencing work. Clean hands thoroughly after work.

13-3-1-3

1 Remove the calliper and brake pads, refer to **Calliper - Removal and Replacement**.

2 Bend the tabs on anti-rotation clip **4**. Remove bolt **3**, anti-rotation clip **4** and washers **5** and **6**. Hold lever **7** against the tension of the spring as the bolt is removed.

3 Note the position of lever **7** and the splines of the shaft. Mark the end of the shaft and lever **7** to aid assembly. Remove lever **7** and spring **8**.

4 Push out rotor **9** and remove ball spacer **10** and ball bearings **11**. Take care not to lose the ball bearings.

5 Push out mounting bushes **12** and remove O-rings **13**.

Note: Shaft seal **14** will not need to be renewed unless excessively worn or damaged. If removal is necessary, press the seal out from inside the housing using a suitable spacer block and bench press. Clean out any remains of the seal after removal.

Inspection

1 Clean and dry all parts. Check all parts are free from excessive wear, damage or corrosion. Light scores or stains should be removed. Renew corroded or deeply scored parts.

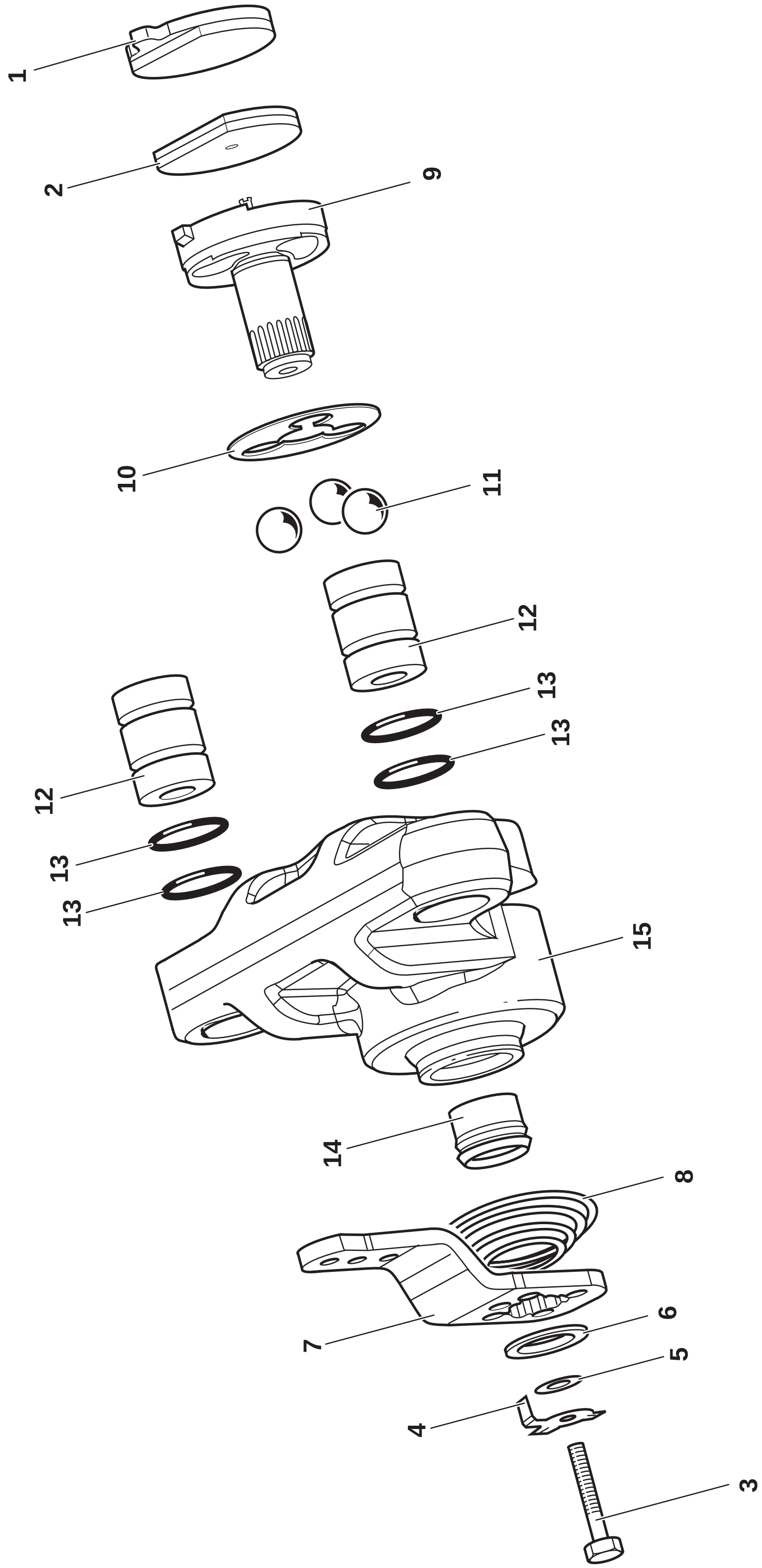
2 Check rotor **9** for damage or distortion. Renew if necessary.

Always renew both brake pads if the parking brake has been used in an emergency.

3 Check the ball pockets in housing **15** for signs of scoring, pitting, damage or corrosion. Renew the housing if damaged.

4 Check spring **8** is not broken or distorted.

5 Check the condition of the disc surface. Renew the disc if badly warped, pitted or worn.


1
2
9
10
11
12
13
13
12
13
13
15
14
8
6
7
5
4
3
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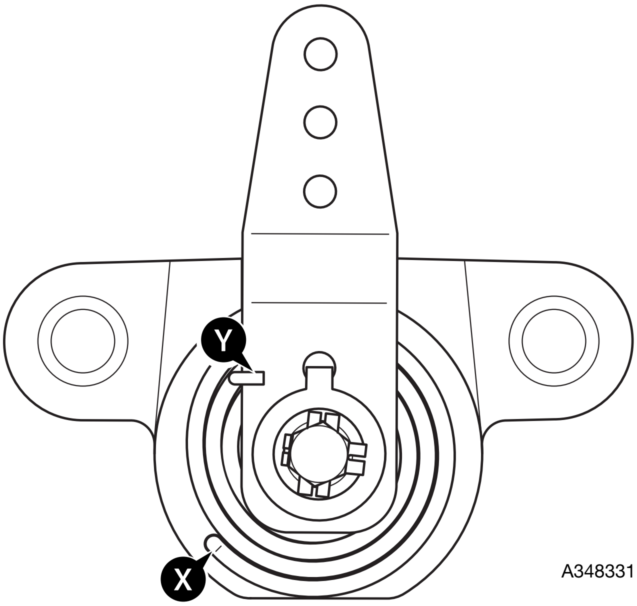
Dismantling and Assembly (cont'd)



Assembly

Before assembly make sure all parts are clean and serviceable.

1 Fit a new shaft seal **14** if removed. Install the seal as shown. Press the seal into the housing using a suitable spacer block and bench press.

2 Coat the the shaft and ball pockets of rotor **9** and the ball pockets of housing **15** with silicone grease.

3 Insert the three ball bearings **11** into the pockets in the housing **15**. Insert ball spacer **10**.

4 Slide rotor **9** through the casting and seat the ball pockets against the bearings.

5 Position spring **8** over the shaft of rotor **9**. Insert the large diameter end of the spring into hole **X** in the face of the housing.

6 Locate the small diameter end of spring **8** around the outside edge of lever **7** as shown at **Y**.

7 Fit lever **7**. Align the lever to the mark made during dismantling.

8 Hold the lever against the tension of the spring and fit washers **6** and **5**, and new anti-rotation clip **4**. Fit bolt **3** and tighten to 13-16 Nm (9-12 lbf ft).

9 Bend up a tab of the anti-rotation clip that aligns with one of the flats on the bolt.

10 Fit the new brake pads, refer to **Service Procedures - Parking Brake - Renewing the Brake Pads**.

11 Lubricate the O-rings **13** and bushes **12** with silicone grease. Fit O-rings into the housing and insert mounting bushes. Wipe off any excess grease.

12 Before fitting the calliper, ensure the lever rotates smoothly and that the lever side pad **2** returns to the off position when the lever is released.

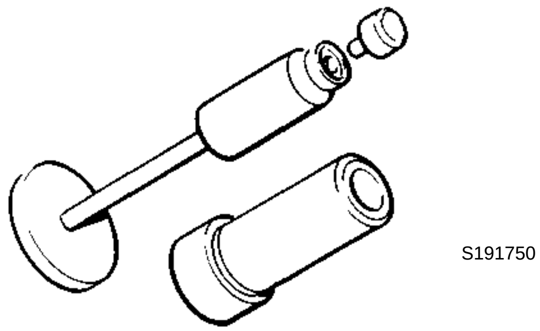
13 Refit the brake calliper. Refer to **Calliper - Removal and Replacement**.

14 Adjust the parking brake, refer to **Service Procedures - Parking Brake - Adjustment**.

Torque Settings

Item	Nm	lbf ft
3	13-16	9-12

Contents **Page No.**



892/0018 Seal Fitting Tool for fitting 'O' ring and kin ring to Hydraulic Steer Unit

System Type

Full Power Hydrostatic permanent 4-wheel steer.
Oil supply from Main Hydraulic Pump via Priority Valve to Steer Unit Valve complete with Load Sensing and Integral Relief Valve.

STEER UNIT - FIG 1

Model	160 OSPC		
- Volumetric Displacement	160 cc/rev		
- Relief Valve	Fitted		
- Check Valve	Fitted		
- Shock Valve	Fitted		
- Relief Valve Operating Pressure (at 1500 revs/min)	120 ± 3 bar	122 ± 3.5 kgf/cm^2	1740 ± 50 lbf/in^2
- Shock Valve Operating Pressure	175 - 190bar	178 - 199 kgf/cm^2	2538 - 2756 lbf/in^2

PRIORITY VALVE - FIG 2

Stand by Pressure	7 bar	7.1 kgf/cm^2	102 lbf/in^2

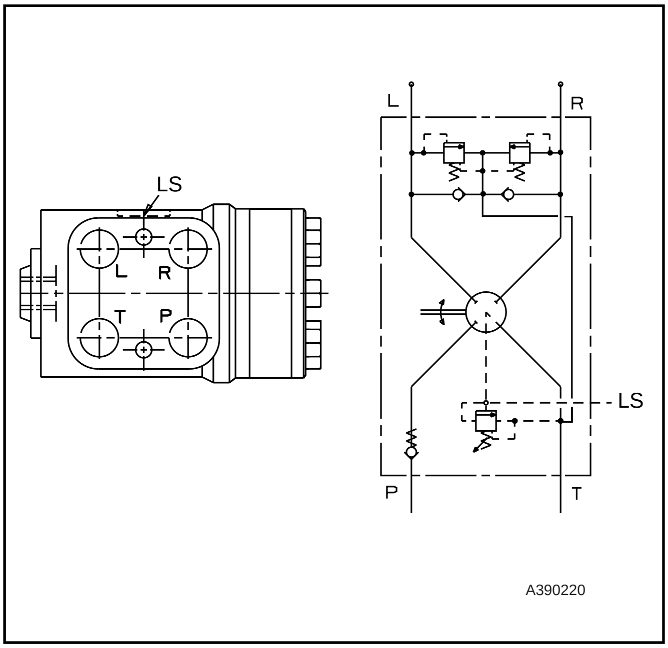


FIG 1

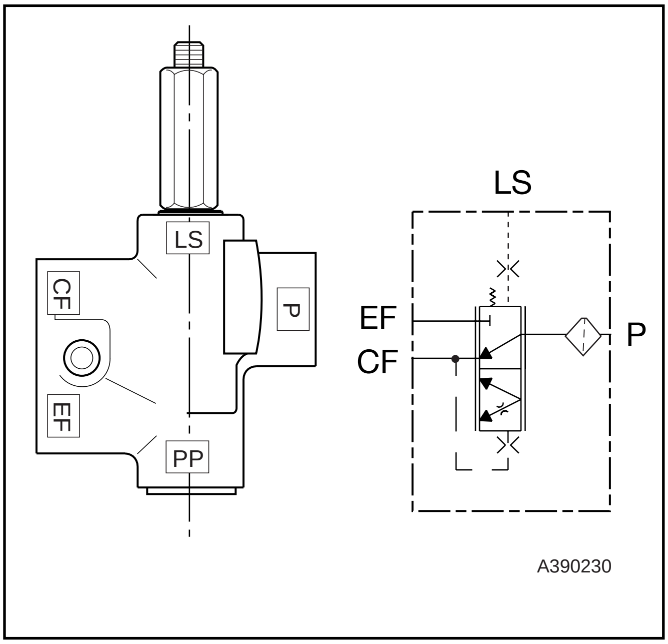


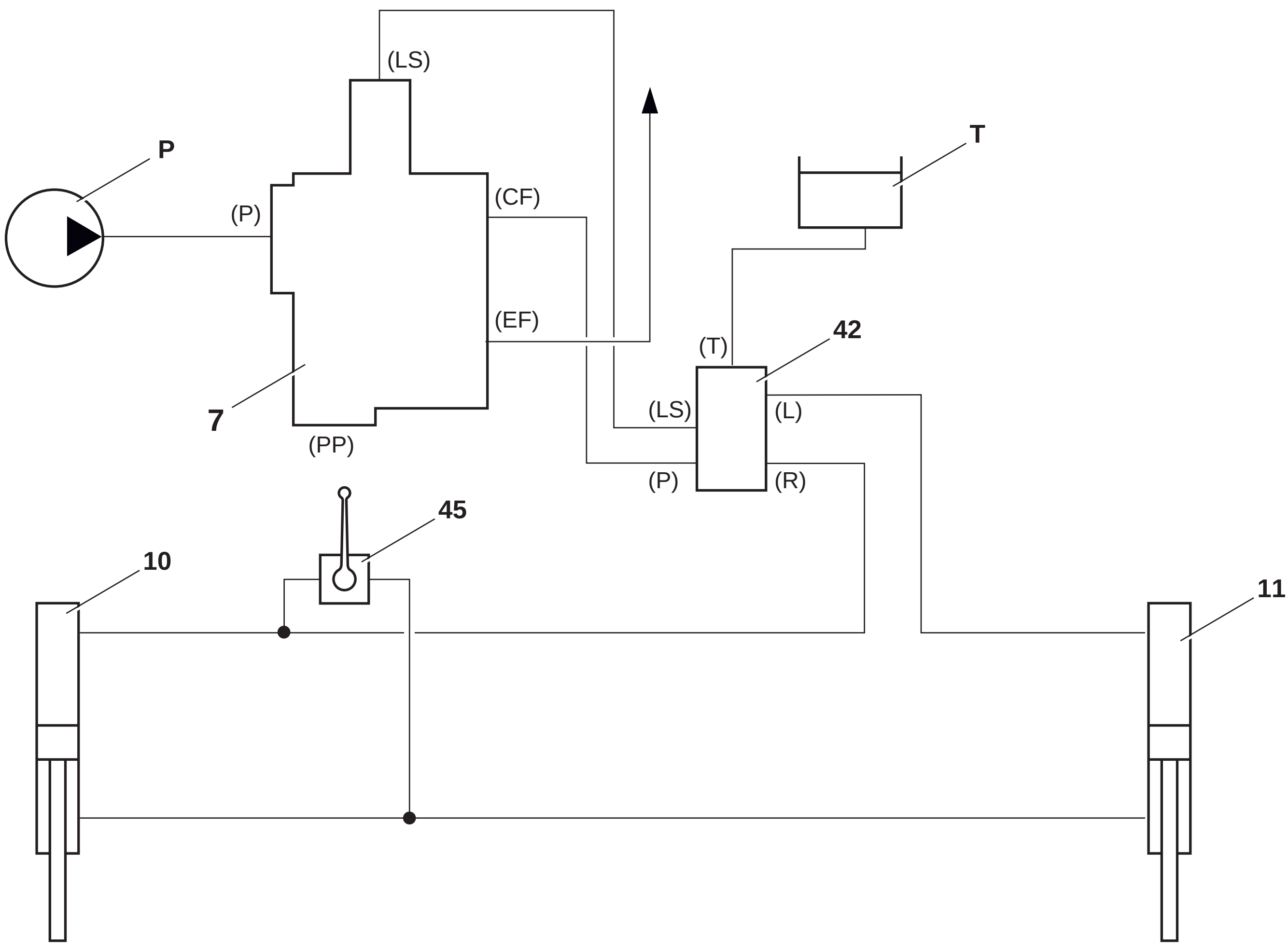
FIG 2

Steer System Schematics

Component Key:

P Pump
T Tank
7 Priority Valve
10 Front Steer Ram
11 Rear Steer Ram
42 Steer Unit
45 Steer Setting Valve

Note: Hydraulic component port identification letters are shown in parenthesis, e.g. (LS). The same letters will be stamped on the actual component.



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Hydraulic Operation

The main components of the steering system are the priority valve **A**, load sensing steer unit **B**, hydraulic tank **C**, front steer ram **D** and rear steer ram **E** and steer setting valve **F**.

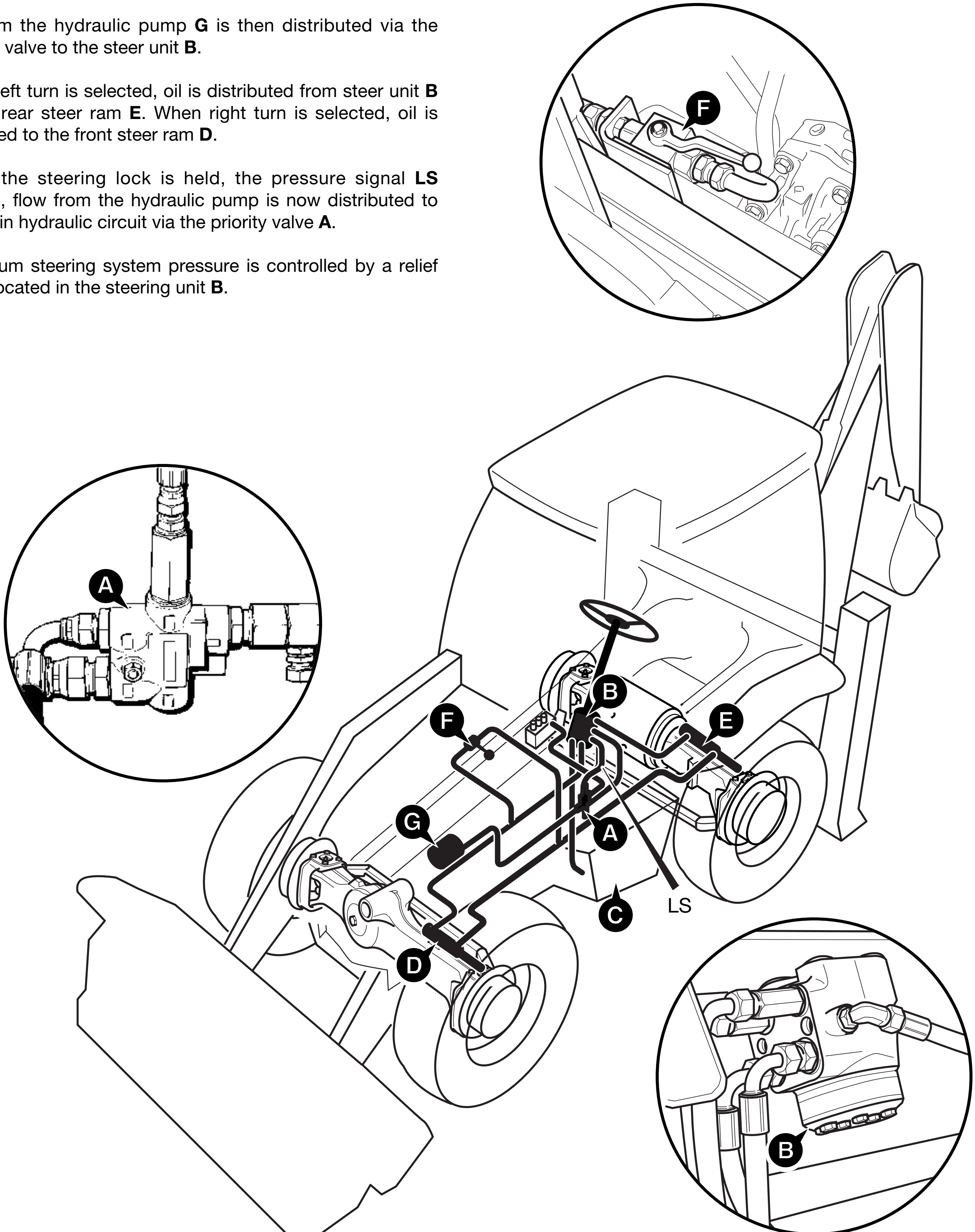
When the steering wheel is turned, a pressure demand is sensed at the priority valve **A** via load sensing line **LS**.

Oil from the hydraulic pump **G** is then distributed via the priority valve to the steer unit **B**.

When left turn is selected, oil is distributed from steer unit **B** to the rear steer ram **E**. When right turn is selected, oil is delivered to the front steer ram **D**.

When the steering lock is held, the pressure signal **LS** ceases, flow from the hydraulic pump is now distributed to the main hydraulic circuit via the priority valve **A**.

Maximum steering system pressure is controlled by a relief valve located in the steering unit **B**.



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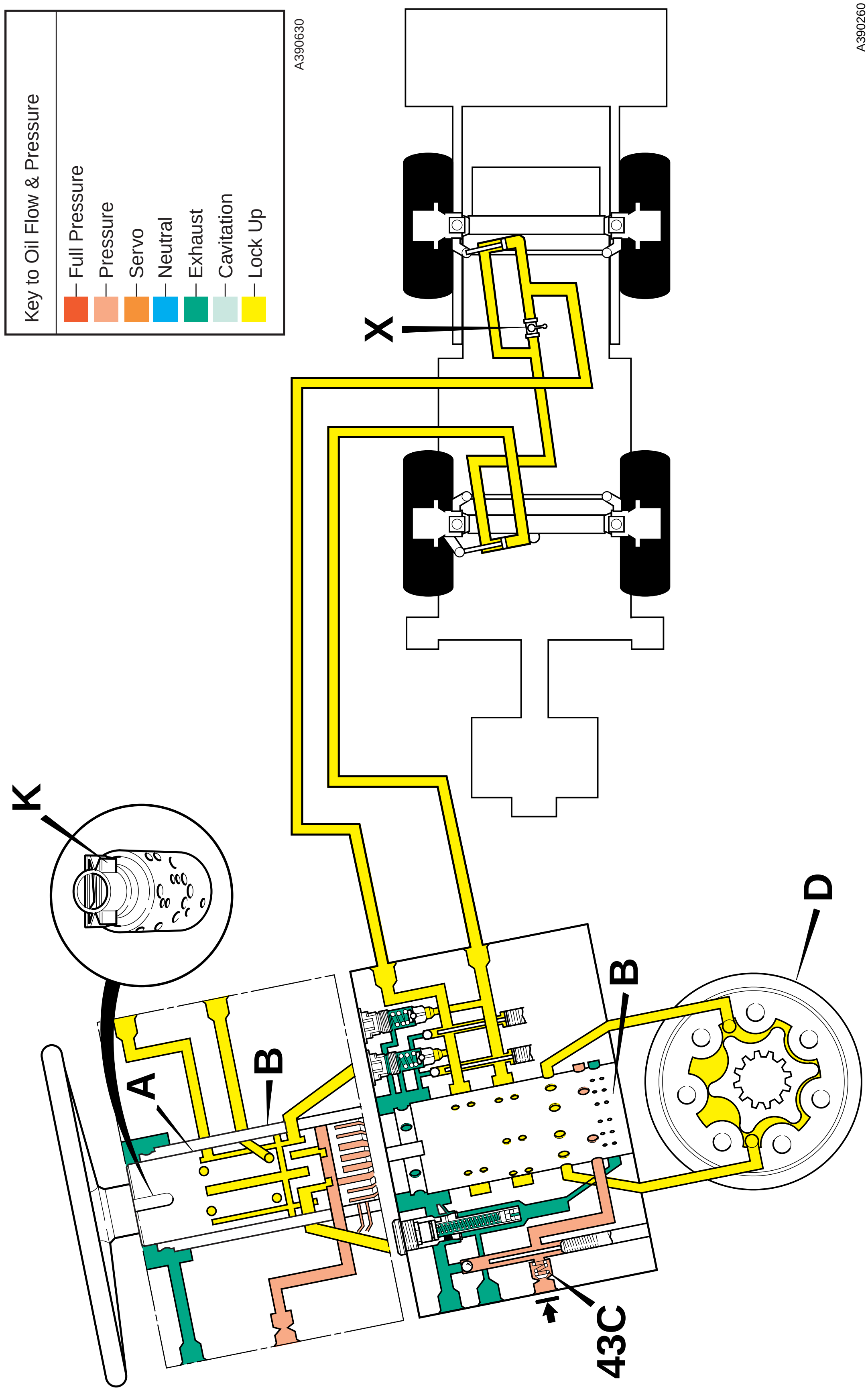
Steer Unit Operation 1 - Neutral

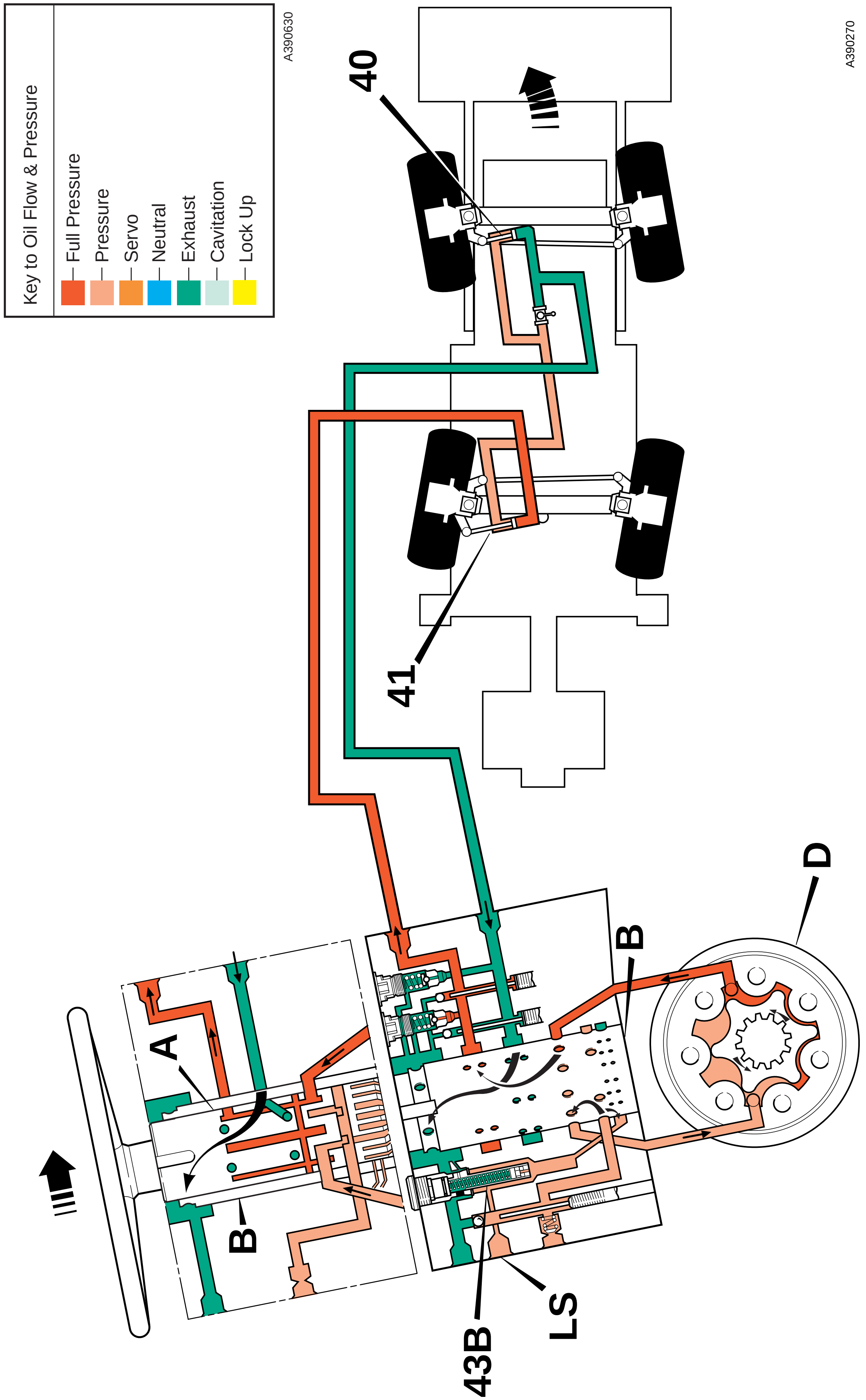
Flow from the priority valve enters the steering unit through the bottom right hand port past the non-return valve **43C**. When the steering wheel is stationary the inner spool **A** and sleeve **B** are held in the neutral position by the centring springs **K**. As the unit is 'closed centre' the flow from the pump is dead ended by the steering unit.

Note: The steer setting valve shown at **X** is always in the closed position for normal steering operation. For further details refer to **Service Procedures - Initial System Bleeding and Re-Aligning the Road Wheels.**

Component Key:

A Inner Spool
B Sleeve
D Stator
K Centring Springs
X Steer Setting Valve
43C Non-Return Valve


Key to Oil Flow & Pressure
Full Pressure
Pressure
Servo
Neutral
Exhaust
Cavitation
Lock Up
A390630
A390260
X
K
A
B
B
D
43C


Key to Oil Flow & Pressure
Full Pressure
Pressure
Servo
Neutral
Exhaust
Cavitation
Lock Up
A390630
A390270
40
41
A
B
B
D
LS
43B

Steer Unit Operation 2 - Left Turn

The illustration shows the flow through the steering unit in a left hand turn condition. Turning the steering wheel rotates the inner spool **A** a few degrees relative to the outer spool **B**, and sends a pressure signal to the relief valve **43B** and through the **LS** port back to the priority valve.

The relative movement between **A** and **B** directs pressure oil through 6 of the 12 holes in the bottom of sleeve **B**. The metering unit is linked to the spools by a cross pin. As the steering is operated the oil is diverted by inner spool **A** into the stator **D**.

The rotor lobes pump the oil out to the head side of rear steering ram **41** turning the rear wheels to the right. At the same time pressurised oil from the rod side of steering ram **41** is fed to the rod side of front steering ram **40**, hence turning the front wheels the required degree of left turn.

Component Key:

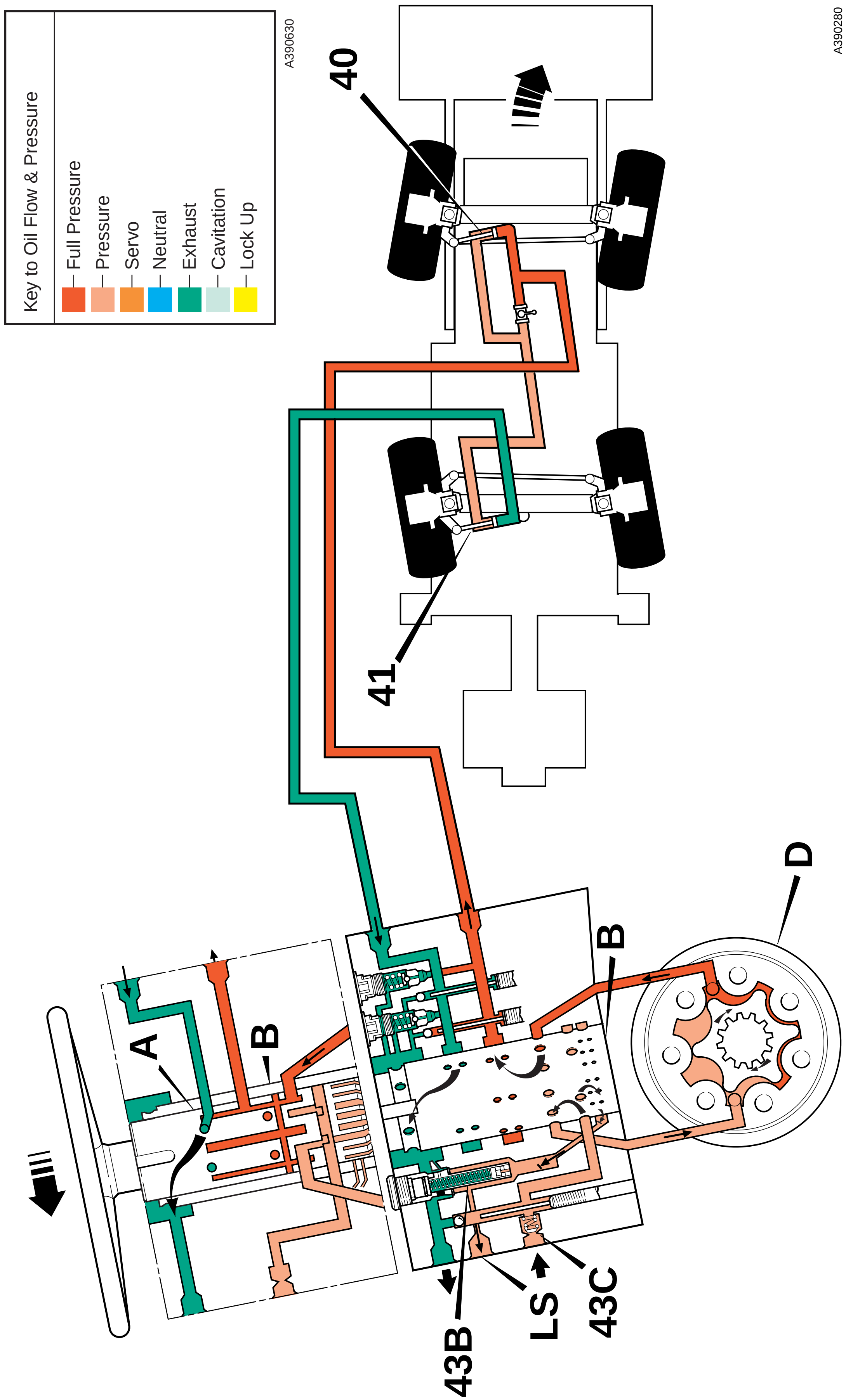
A Inner Spool
B Outer Spool
D Stator
LS Load Sensing Port
40 Front Steer Ram
41 Rear Steer Ram
43B Relief Valve

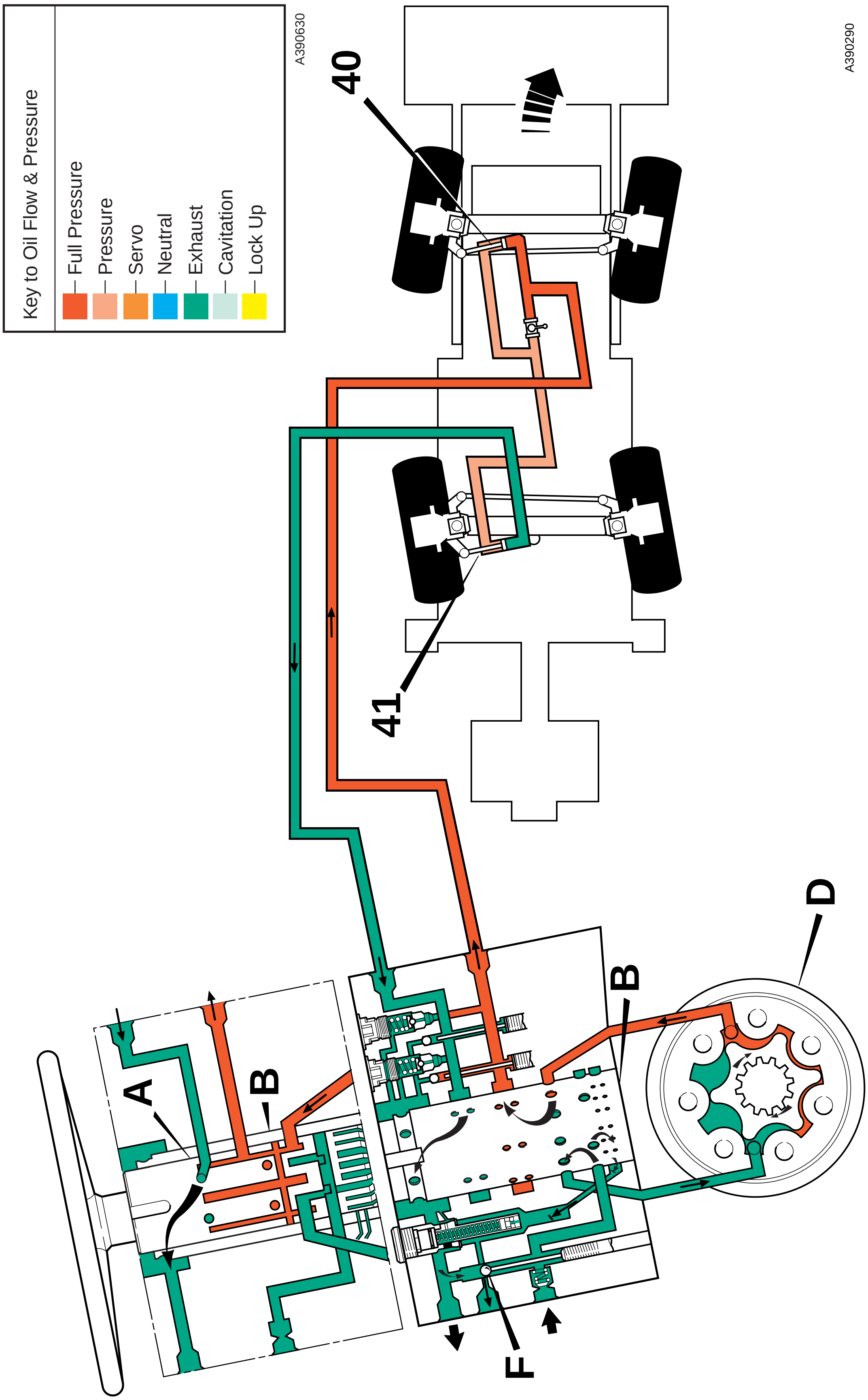
Steer Unit Operation 3 - Right Turn

The illustration shows the flow through the steering unit in a right hand turn condition. The operation is identical to that described on the previous page, except that the oil is diverted by spool **A** to the other side of stator **D** and rams **40** and **41**.

Component Key:

A Inner Spool
B Outer Spool
D Stator
LS Load Sensing Port
40 Front Steer Ram
41 Rear Steer Ram
43B Relief Valve
43C Non-Return Valve


Key to Oil Flow & Pressure
Full Pressure
Pressure
Servo
Neutral
Exhaust
Cavitation
Lock Up
A390630
A390280
40
41
A
B
B
D
43B
LS
43C


Key to Oil Flow & Pressure
Full Pressure
Pressure
Servo
Neutral
Exhaust
Cavitation
Lock Up
A390630
A390290
40
41
A
B
B
D
F

Steer Unit Operation 4
- Right Turn, Unassisted

The illustration shows the circuit operation with the engine stopped. Turning the steering wheel rotates the inner spool **A** until the cross pin engages with and rotates outer sleeve **B**, metering oil to the stator **D**, and pumping it out to rams **40** and **41** under manual pressure only.

As there is no supply from the pump, oil from one side of the rams, supplemented by exhaust oil if necessary, is used to feed the other side via non-return valve **F**.

Component Key:

A Inner Spool
B Outer Spool
D Stator
F Non-Return Valve
40 Front Steer Ram
41 Rear Steer Ram

Steer Unit Operation 5 - Shock Valve

In normal operation oil flow from the pump enters the steering unit via the right hand port, opening a spring-loaded non-return valve **43C.** The flow is directed by the steering unit to achieve the desired turn (right hand shown).

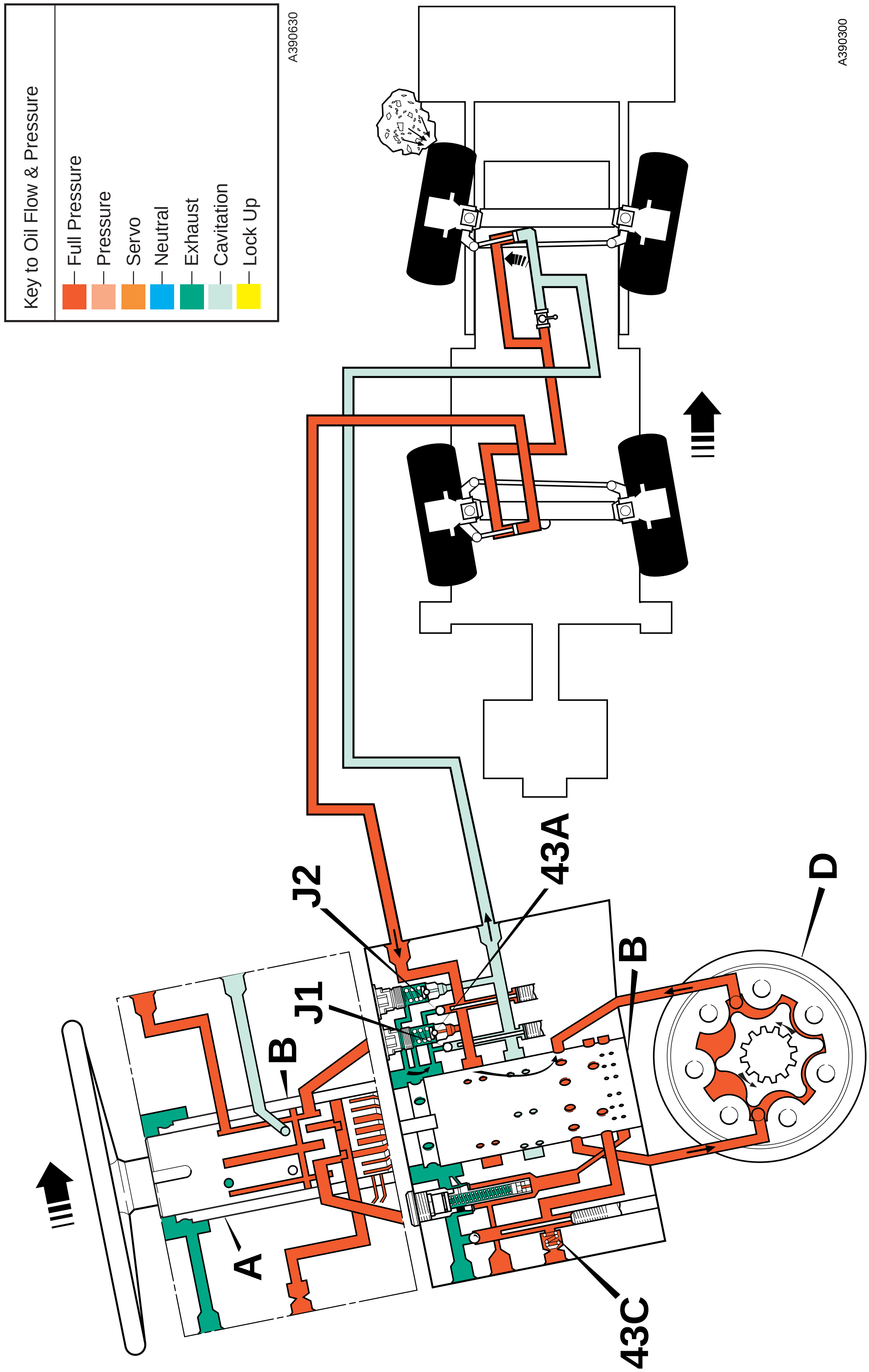
In the event of a pressure shock wave being generated in the system by an outside force, shock valve **43A** vents this pressure to exhaust preventing damage to the steering unit.

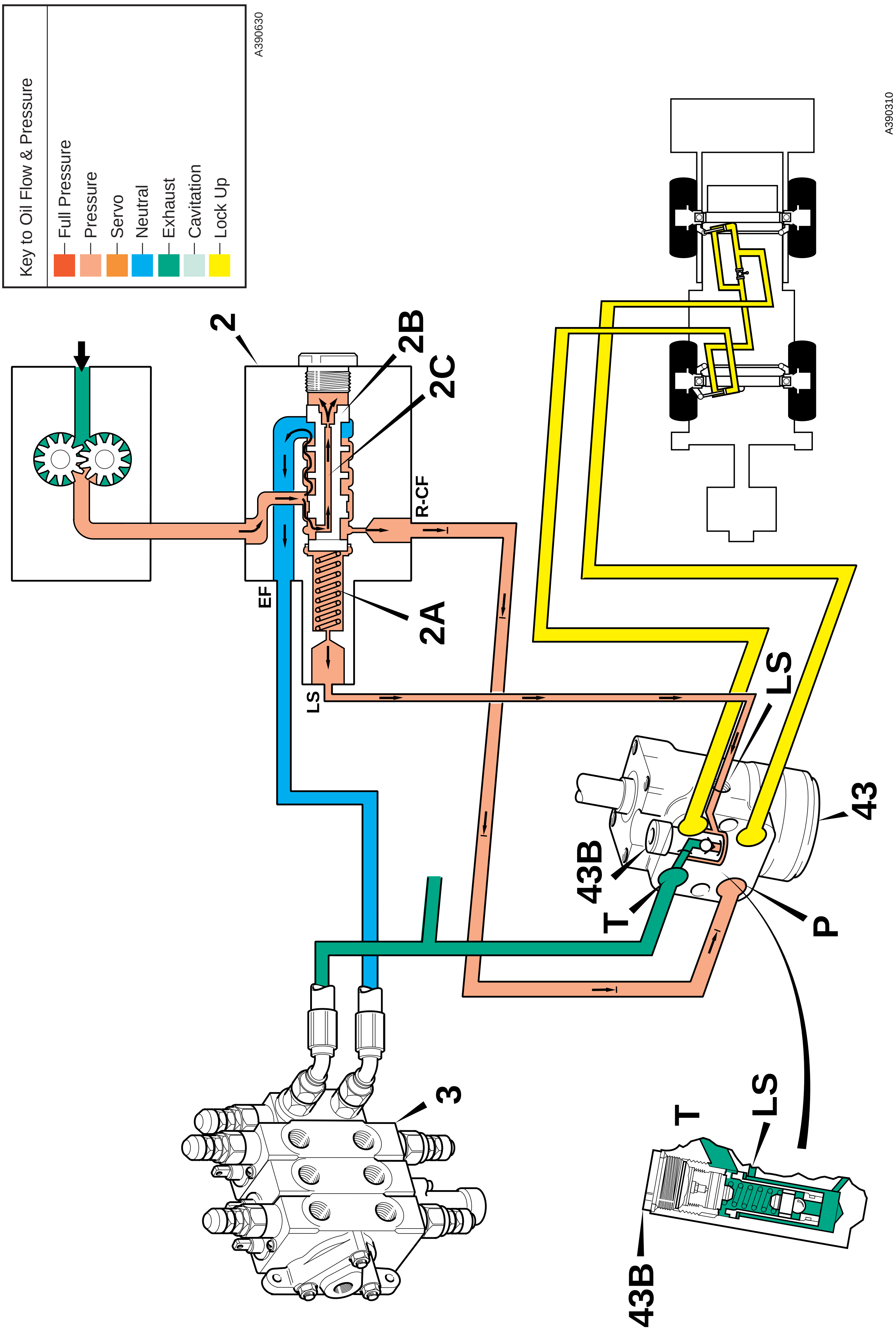
Non-return valve **J2** is held on its seat by the generated pressure and non-return valve **43C** closes to prevent the shock wave being fed back to the pump. Some of the excess flows via non-return valve **J1** to the opposite side of the ram to prevent cavitation occuring.

Component Key:

A Inner Spool
B Outer Spool
D Stator
J1 Non-Return Valve
J2 Non-Return Valve
43A Shock Valve
43C Non-Return Valve

Circuit Description




Key to Oil Flow & Pressure
Full Pressure
Pressure
Servo
Neutral
Exhaust
Cavitation
Lock Up
A390630
A390310
2
2B
2C
R-CF
EF
2A
LS
LS
43
43B
T
P
3
T
LS
43B

Priority Valve Operation 1 - Neutral

When the steering is not being operated, flow to the steering circuit is dead ended by the closed centre steering unit **43** and no load is sensed in line **LS**. Pressure from the main pump to the priority valve is fed via a drilling **2C** to the rear of spool **2B.** The high pressure differential created across the spool causes it to move to the left against the force of the spring **2A**. This allows full pump flow to the loader control valve **3.**

Component Key:

LS Load Sensing Port
P From pump
T To Loader Valve
2 Priority Valve
2A Spring
2B Spool
2C Drilling
3 Loader Valve
43 Steer Unit
43B Relief Valve

Priority Valve Operation 2 - Turning

As the steering unit **43** is operated, pressure is applied to the spring end of the priority valve spool **2B** via sensing line **LS** from the steering unit.

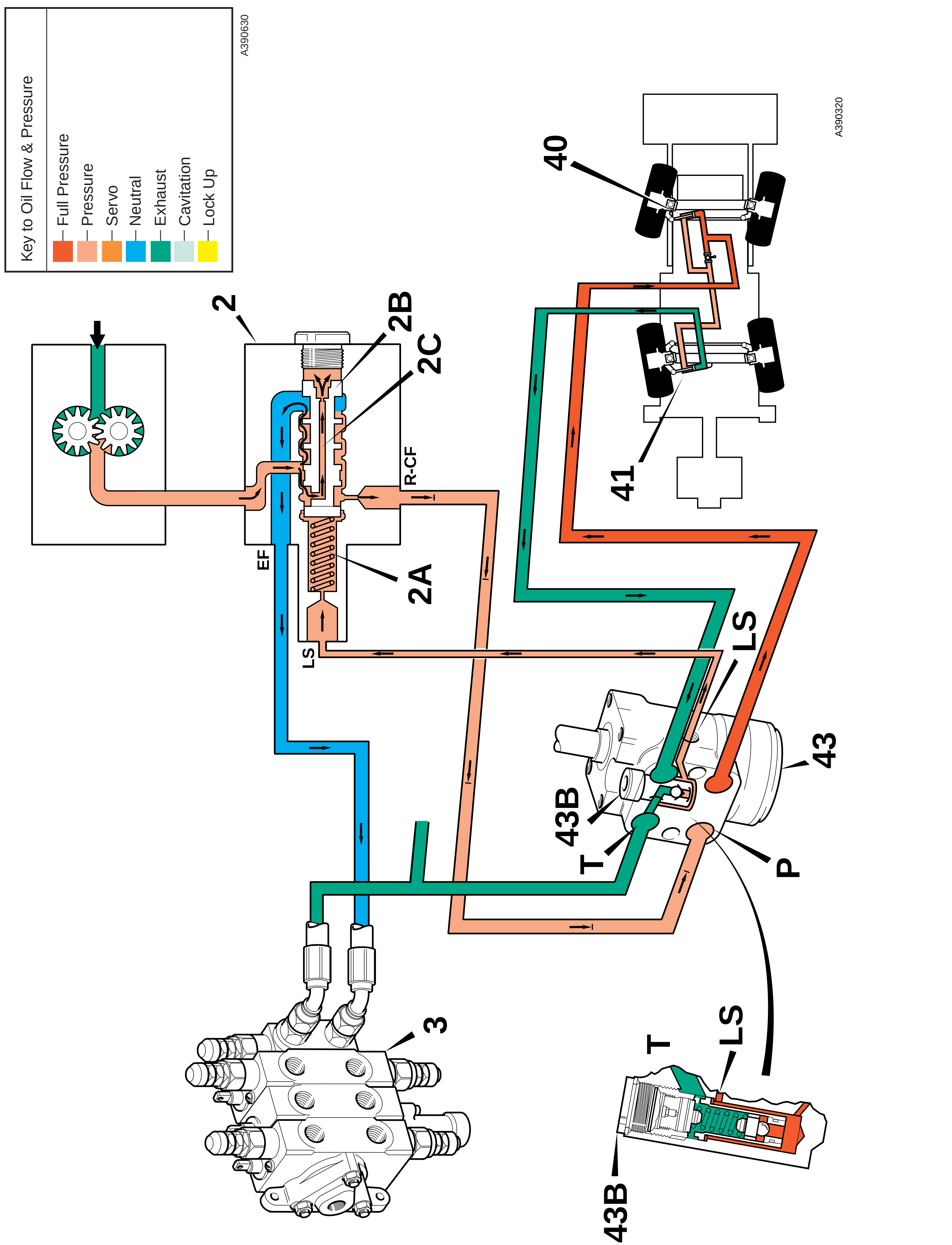
This reduces the pressure differential across the spool, causing it to move to the right under spring pressure. This allows priority valve flow to the steering unit which directs the flow to the steer rams **40** and **41** untill the required steering lock is reached. When the steering lock is held the pressure signal across the side port **LS** of the steering unit ceases, restoring the pressure differential across spool **2B**. The spool moves back to the left, allowing ful pump flow to the loader control valve **3**.

Because the pump output is always greater than the flow required to operate the steering system, flow to the loader valve is never completley cut off.

Maximum steering system pressure is controlled by relief valve **43B**, located in the steeering unit **43**.

Component Key:

LS Load Sensing Port
P From pump
T To Loader Valve
2 Priority Valve
2A Spring
2B Spool
2C Drilling
3 Loader Valve
40 Front Steer Ram
41 Rear Steer Ram
43 Steer Unit
43B Relief Valve


Key to Oil Flow & Pressure
Full Pressure
Pressure
Servo
Neutral
Exhaust
Cavitation
Lock Up
A390630
A390320
2
2A
2B
2C
3
40
41
43
43B
R-CF
EF
LS
T
P

Fault Finding Contents

Introduction

The purpose of this section is to help you trace hydraulic faults to a faulty unit (E.g. valve, actuator, ram etc). Once you have traced the faulty unit, refer to the appropriate dismantling, inspecting and test instructions given elsewhere in the steering section.

To help identify circuits, valves, rams etc mentioned in the fault finding procedures, refer to the hydraulic schematic diagrams (near the beginning of the Hydraulics Section).

1 Before you begin fault finding, read the Safety information at the beginning of this manual.

2 Make simple checks before say, stripping a major component.

3 Make sure that the hydraulic fluid is at correct working temperature (50 °C, 122 °F).

4 What ever the fault, check the condition of the hydraulic fluid. Drain and replace if necessary.

5 Make any relevant electrical checks before moving on to the hydraulics.

6 Be sure to remove ALL contamination and if possible identify its origin. It may be part of a component from elsewhere in the circuit.

7 Replace any seals such as 'O' rings before re-assembling hydraulic components.

Fault	Probable Cause	Action
1 Steering wheel difficult to turn.	Tyres not inflated to correct pressure.	Inflate tyres to correct pressure.
	Insufficient hydraulic fluid.	Check for leaks and top up the hydraulic tank as required.
	Leaks in the relevant hoses or component connections.	Check hoses and connections for leaks.
	Air in the hydraulic system.	Bleed system - bleed the load sense line.
	Low pump flow.	Check pump flow, service or replace pump if required.
	Steer unit relief valve set incorrectly.	Check pressure setting of steer unit relief valve, adjust as required.
	Worn or damaged parts in the steer unit.	Remove and inspect.

.... continued

Fault	Probable Cause	Action
1 Steering wheel difficult to turn. (continued)	Priority valve not operating correctly.	Check if the priority valve is sticking, rectify as required.
		Check the load sense line from the steer unit to the priority valve for signs of leaking or poor connection.
	Mechanical failure.	Check for damaged axle components, such as rams, trackrods, linkages etc.
2 Steering wheel turns on its own.	Dirt in the steer unit. (causing sleeves to stick open)	Clean and inspect unit.
	Steer unit valve centring springs damaged, broken or missing.	Check steer unit.
	Steer unit valve - position of rotor to shaft slot incorrect.	Refer to **Hydraulic Steer Unit - Dismantling and Assembly**. Correct as required.
3 Machine will not turn when the steering wheel is turned.	Insufficient hydraulic fluid.	Check for leaks and top up the hydraulic tank as required.
	Leaks in the relevant hoses or component connections.	Check hoses and connections for leaks.
	Air in the hydraulic system.	Bleed system - bleed the load sense line.
	Low pump flow.	Check pump flow, service or replace pump if required.
	Steer unit relief valve set incorrectly.	Check pressure setting of steer unit relief valve, adjust as required.
	Worn or damaged parts in the steer unit.	Remove and inspect.
	Priority valve not operating correctly.	Check if the priority valve is sticking, rectify as required.
		Check the load sense line from the steer unit to the priority valve for signs of leaking or poor connection.

Fault	Probable Cause	Action
3 Machine will not turn when the steering wheel is turned (continued).	Mechanical failure.	Check for damaged axle components, such as rams, trackrods, linkages etc.
	Steer column splined shaft not fully engaged in steer unit.	Check shaft engagement.
	Steer ram failure.	Check steer ram for signs of damge, leaks etc.

Initial System Bleeding

If a steering system component has been replaced, e.g., a steer ram, or after a steering hose burst the following procedure must be followed:

1 Start the engine.

2 Carefully raise the front wheels just clear of the ground using the shovel.

3 Stop the engine.

4 Open the bonnet. Move the setting lever **A** to the **SET** position **S** as shown.

5 Start the engine.

6 Turn the steering wheel to full left lock (only the rear wheels will move).

7 Stop the engine.

8 Disconnect the hydraulic hose from the rod side of the rear steer ram, draining the hydraulic fluid into a suitable container.

9 Start the engine.

10 Turn the steering wheel to full right lock.

11 Stop the engine.

12 Reconnect the rear steer ram rod side hose.

13 Start the engine.

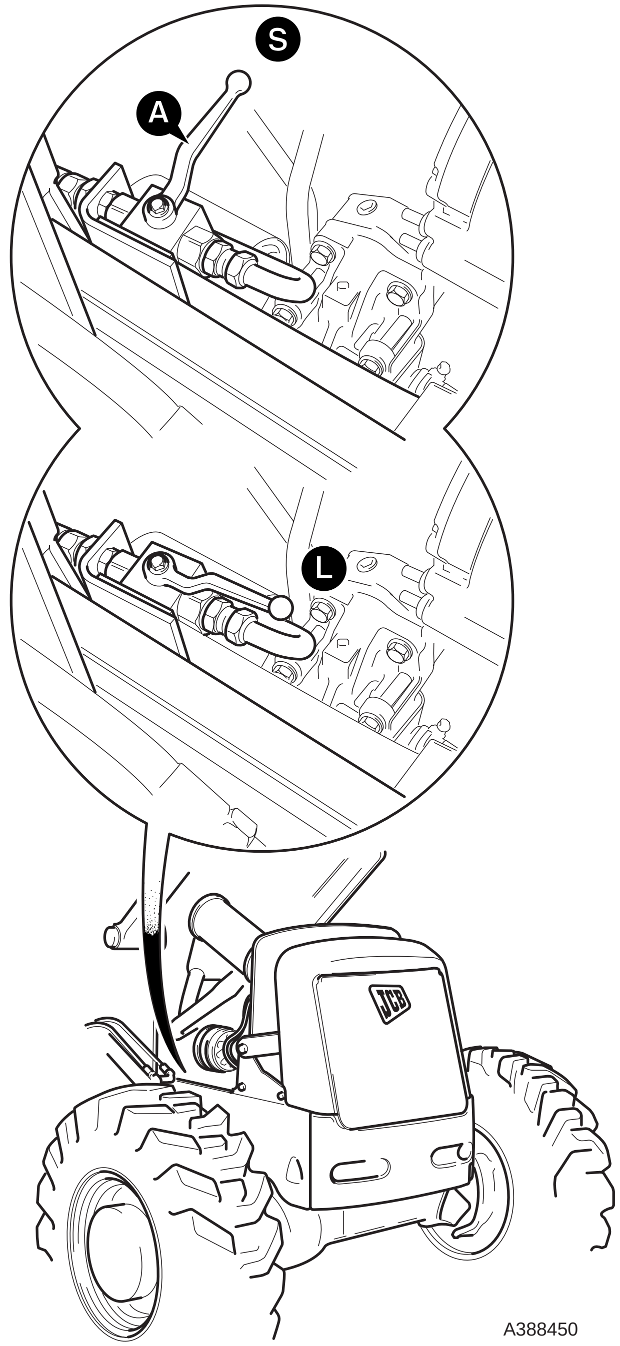
14 Turn the steering wheel to full right lock.

15 Move setting lever **A** to the **LOCK** position **L** as shown.

16 Repeat steps **1** to **16** if necessary.

17 Lower the front wheels to the ground and stop the engine.

18 Top up the hydraulic fluid level as required.



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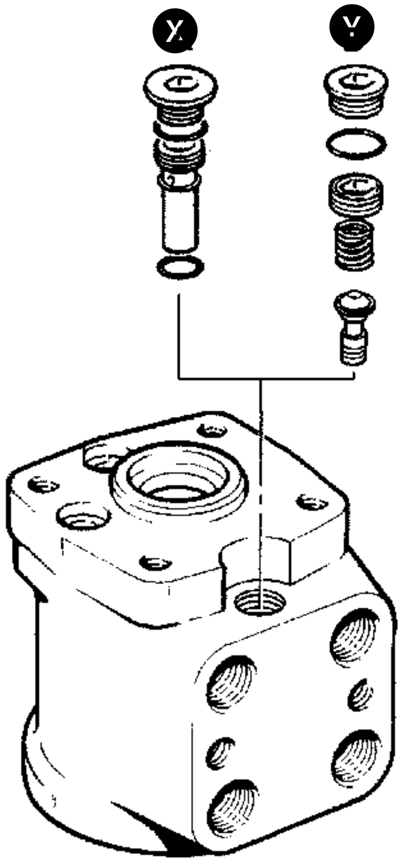
Steering System Pressure Testing



S212750

1 Park the machine on level ground, engage the parking brake and set the transmission to neutral. Lower the attachments to the ground. Stop the engine and remove the starter key.

2 Turn the steering wheel to the left and to the right several times to vent system pressure.

⚠ WARNING

Make the machine safe before working underneath it. Park the machine on level ground, lower the arms. Apply the parking brake, put the transmission in neutral and stop the engine. Chock both sides of all four wheels.

Disconnect the battery, to prevent the engine being started while you are beneath the machine.
GEN-1-2

3 Connect a 0-400 bar (0-6000 lbf/in^2) pressure gauge to test adaptor **A**.

Note: The pressure test point for the steering circuit is fitted next to the priority valve as shown.

4 Run the engine at 1500 revs/min and turn the steering to full lock. Check the gauge reading which should equal the relief valve pressure, refer to **Technical Data**.

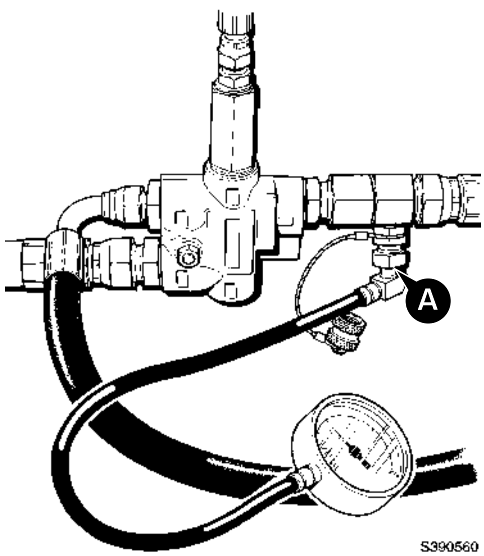
Note: The steering wheel must be held on full lock whilst the gauge reading is being checked.

5 If necessary, adjust the pressure setting by removing plug **B**, on the orbitrol steering unit.

6 Adjust screw **C** using an 'allen key' until the correct pressure is shown on the gauge.

Note: Detail **X** shows a relief valve which has a 4 mm hexagon adjusting screw. Detail **Y** shows a valve which has a 6 mm hexagon adjusting screw.

7 Refit plug **B**.



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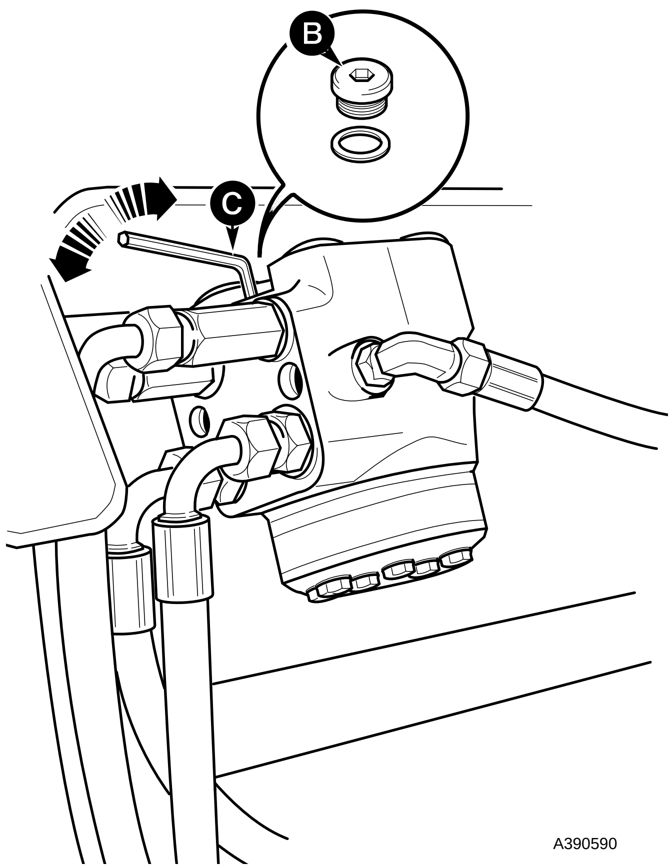


A390590

Re-Aligning the Road Wheels

⚠ WARNING

At the start of each working period, and at least once a day, or if having difficulty in steering, check and, if necessary, re-align the road wheels.

2-1-1-10

1 Start the engine.

2 Turn the steering wheel to full right lock.

3 Stop the engine and remove the starter key.

4 Open the bonnet. Move the setting lever **A** to the **SET** position **S** as shown.

⚠ WARNING

The engine has exposed rotating parts. Switch OFF the engine before working in the engine compartment. Do not use the machine with the engine cover open.

5-2-6-5

5 Start the engine.

6 Continue to turn the steering wheel to full right lock until full/maximum travel is obtained.

7 Stop the engine and remove the starter key.

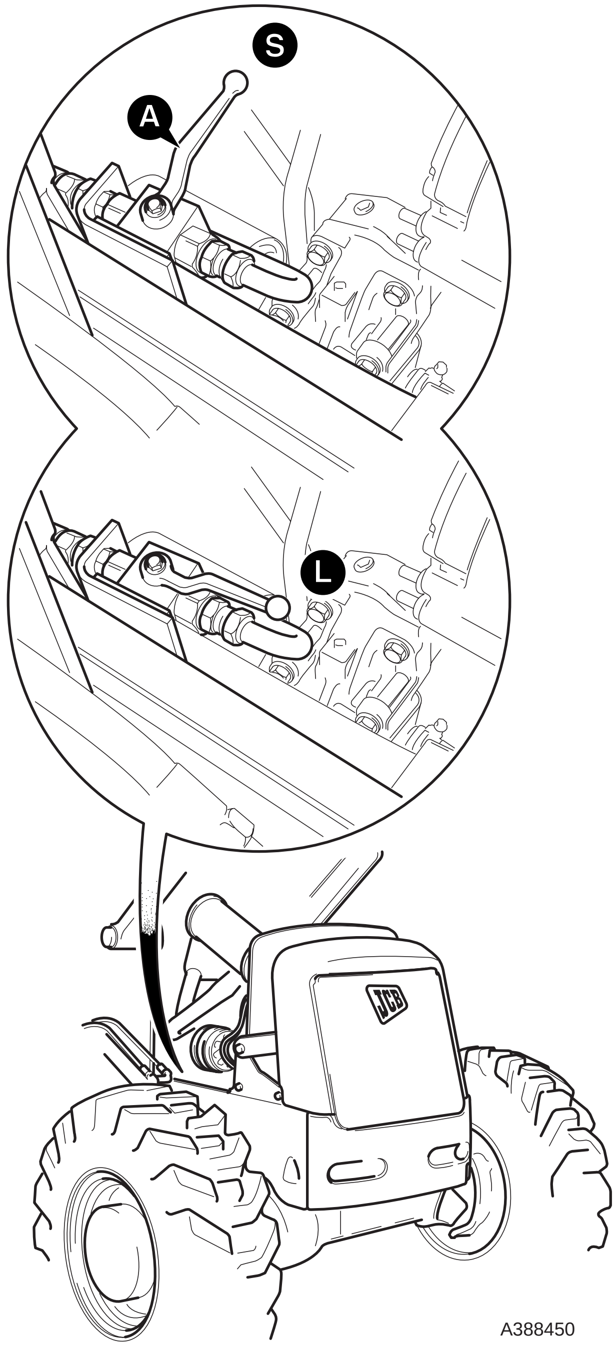
8 Move the setting lever **A** to the **LOCK** position **L** as shown and close the bonnet.

9 Repeat steps **1** to **8** if necessary.

⚠ DANGER

The steering setting lever must be in the FULLY LOCK position before driving the machine, failure to do so will result in a loss of steering. The setting lever must not be removed or modified.

5-2-6-6



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Removal

⚠ WARNING

Make the machine safe before getting beneath it. Lower the attachments to the ground; engage the parking brake; remove the starter key, disconnect the battery.

2-3-2-2

Carry out the geneal safety procedures detailed in Section 3 **Machine Safety**.

The following procedure applies to the steer rams on the front and rear axles:

1 Disconnect the two hoses **A**, making a note of the ram connections they came from. Blank the hoses and plug the ram ports to prevent ingress of dirt.

2 Remove screws **B** and pins **C** at each end of the ram and lift the ram clear.

Replacement

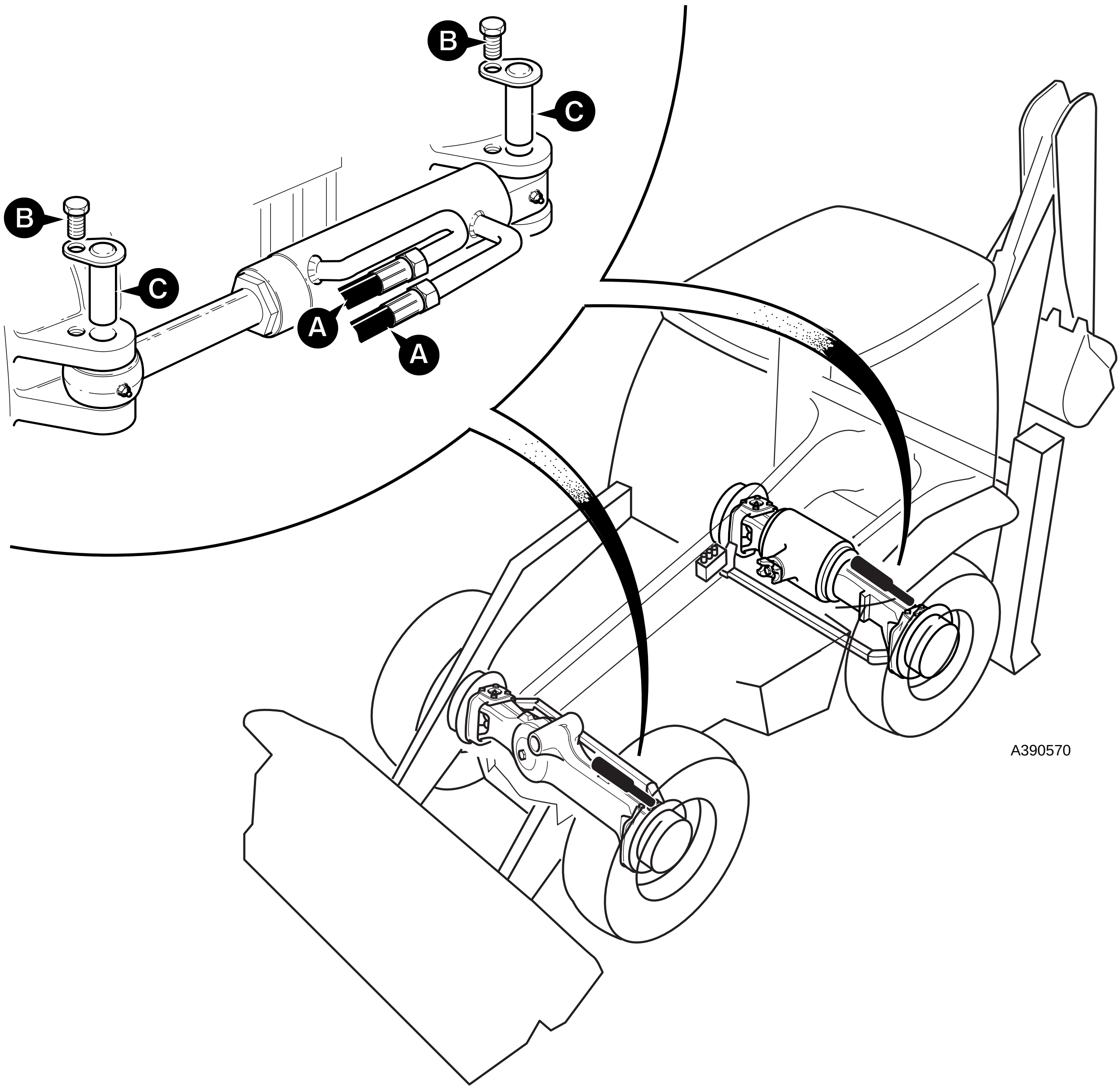
Replacement is the reverse of removal.

Torque Settings

Item	Nm	kgf m	lbf ft
B	56	5.7	41

Dismantling and Assembly

Refer to Section E **Hydraulic Rams, Typical Ram, Dismantling and Assembly**.



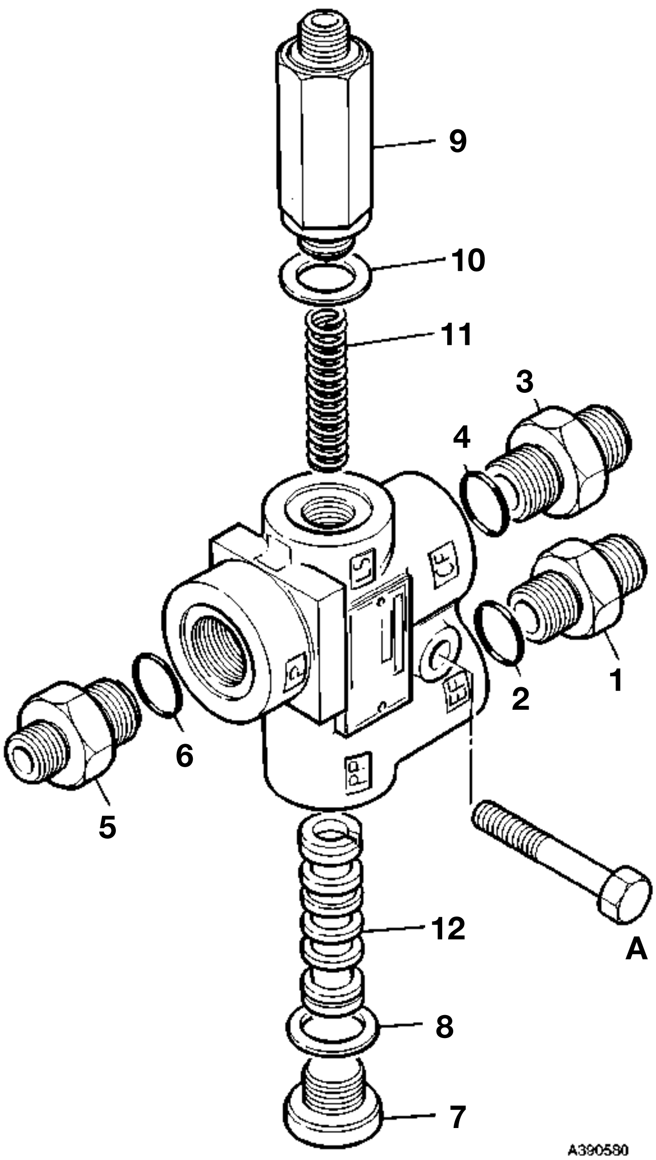
Removal and Replacement

⚠ WARNING

Make the machine safe before getting beneath it. Lower the attachments to the ground; engage the parking brake; remove the starter key, disconnect the battery.
2-3-2-2

The priority valve is mounted on the left hand side chassis member, behind the hydraulic tank. It is attached to the chassis member by one bolt **A**, and is accessible from underneath the machine.

When replacing always renew sealing 'O' rings **2**, **4**, **6**, and **10**.



Dismantling and Assembly

The numerical sequence shown on the illustration is intended as a guide to dismantling.

For assembly the sequence should be reversed.

Dismantling

Press out the spool item **12** using a nylon pin. Take care not to damage the bores of the valve.

Assembly

Make sure that spring seat of spool **12** faces toward **LS** connection.

Clean all parts in clean paraffin.

Lubricate all parts with hydraulic fluid.

Renew aluminium washers **8** and **10**.

Note: All hydraulic adapters that are installed together with a bonded sealing washer must also have JCB Threadseal applied to the threads of the adapter.

Torque Settings

Item	Nm	lbf ft
7	50	37
9	50	37

Bleeding

To bleed the **LS** line, start the engine, loosen the connection on the valve, turn and hold the steering wheel fully in either direction. When bubble free oil flows from the joint, tighten the connection.

Removal and Replacement

Removal

⚠ DANGER

Hydraulic Pressure

Hydraulic fluid at system pressure can injure you. Before disconnecting or connecting hydraulic hoses, stop the engine and operate the controls to release pressure trapped in the hoses. Make sure the engine cannot be started while the hoses are open.

INT-3-1-11/1

1 Park the machine on level ground, engage the parking brake and set the transmission to neutral. Lower the attachments to the ground. Stop the engine and remove the starter key.

2 Turn the steering wheel to the left and to the right several times to vent system pressure.

3 Disconnect and cap all hydraulic hoses from the steering unit as shown at **A**. Label the hoses to ensure correct refitting.

4 Get an assistant to hold of the steering unit, and, working inside the cab, loosen and remove 4 bolts **B**. Lift the steering unit from the machine.

Replacement

⚠ WARNING

Fine jets of hydraulic fluid at high pressure can penetrate the skin. Do not use your fingers to check for hydraulic fluid leaks. Do not put your face close to suspected leaks. Hold a piece of cardboard close to suspected leaks and then inspect the cardboard for signs of hydraulic fluid. If hydraulic fluid penetrates your skin, get medical help immediately.

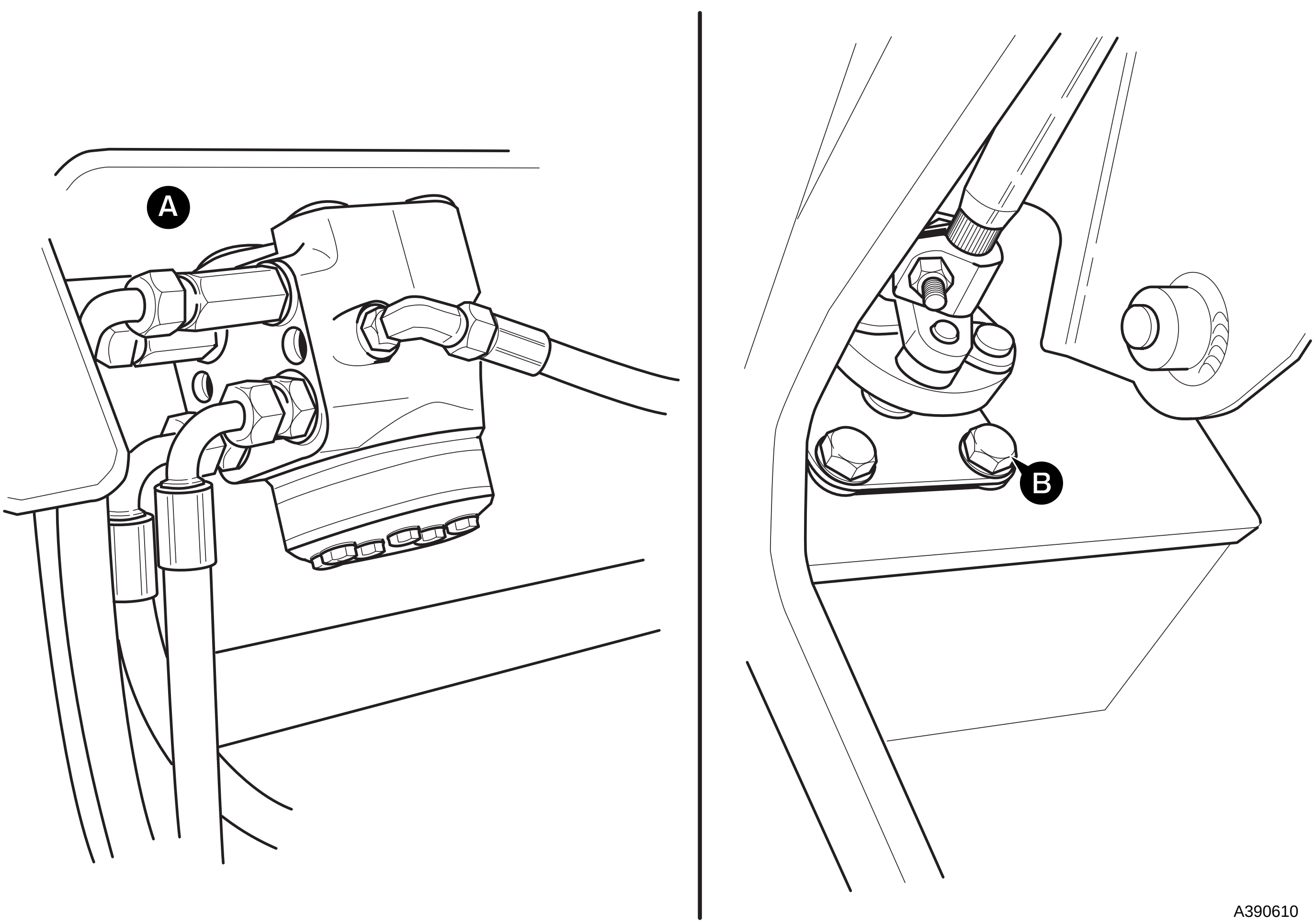
INT-3-1-10/1

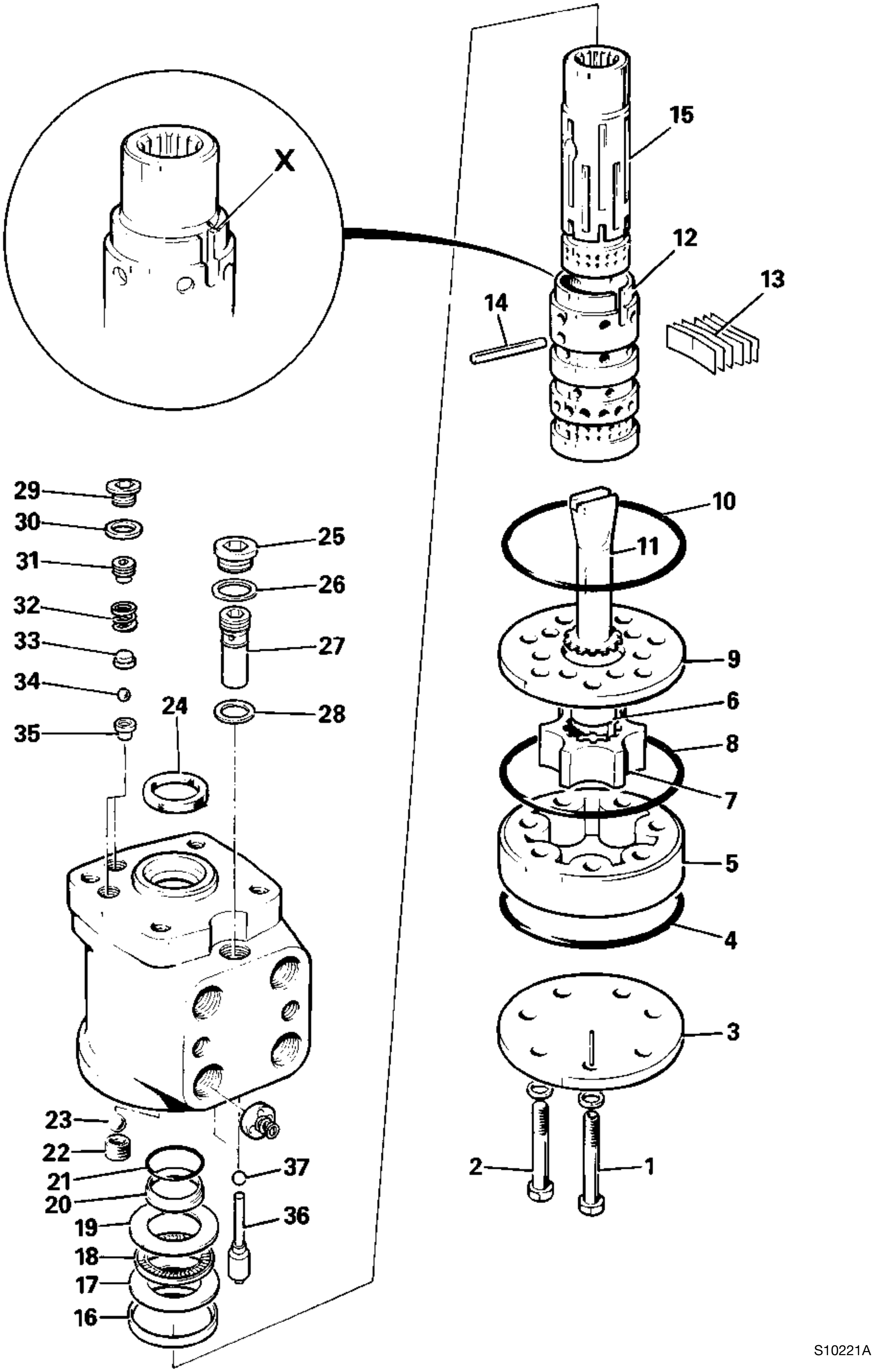
1 Replacement is a reversal of the removal sequence. Make sure that the hoses are correctly installed.

2 Bleed the steering system, refer to **Service Procedures - Initial System Bleeding**.

3 If a new steering unit has been fitted then the system relief valve must be tested for correct pressure setting, refer to **Service Procedures - Steering System Pressure Testing**.

Note: All hydraulic adapters that are installed together with a bonded sealing washer must also have JCB Threadseal applied to the threads of the adapter.




X
15
12
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14
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S10221A

Dismantling and Assembly

The numerical sequence shown on the illustration is intended as a guide to dismantling.

Note: 1 During manufacture, a small mark **X** will have been made on sleeve **12** and spool **15**, close to one of the slots for the centring springs **13**. Before removing the centring springs, check that this mark is visible; if not, make a new mark to ensure correct assembly.

Note: 2 Shock valves (items **29** to **35**) are pressure set during manufacture and the adjusting screw **31** secured with Loctite. Due to the difficulty of resetting the pressure it is recommended that the valves are not disturbed. If dismantling is unavoidable, however, measure and record the depth of adjusting screw **31** below the top face of the steering unit before removing the screw.

Note: 3 The unit illustrated in the following sequence represents a typical hydraulic steer valve. The relief valve (items **25** to **28**) and shock valves (items **29** to **35**) are not therefore shown in the following illustrations.

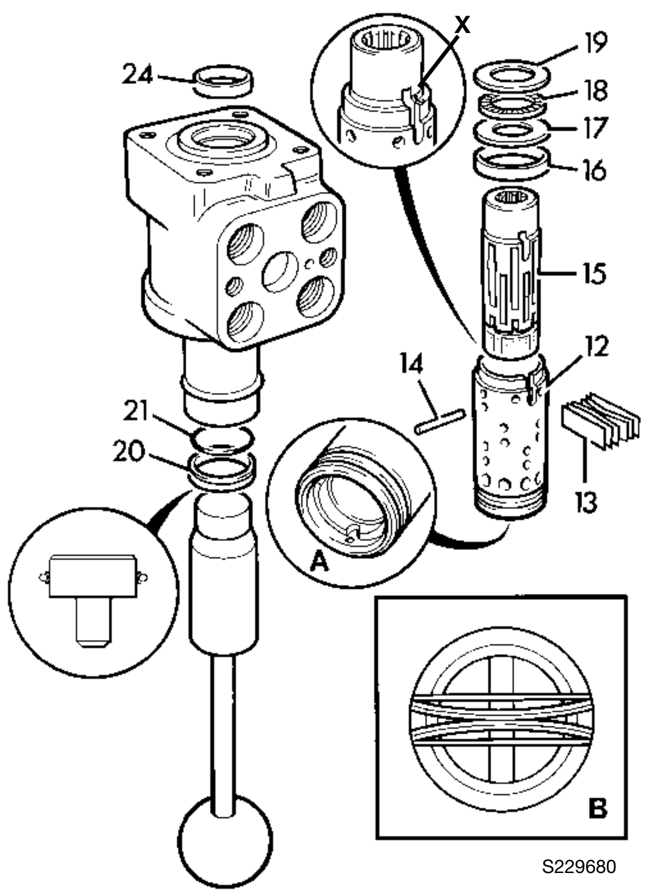
Assembly

1. Fit spool **15** into sleeve **12**, aligning slots for centring springs **13** and checking that the small marks **X** are aligned. Ensure that three slots in spool partially uncover three holes in sleeve, as at **A**.

2. Fit two flat centring springs **13** with four curved springs between them, as shown at **B**.

3. Fit seal **24** into steer unit body and insert sleeve of service tool 892/00180. Fit back up ring **20** and seal **21** onto plastic boss, and position on tool spindle, as shown.

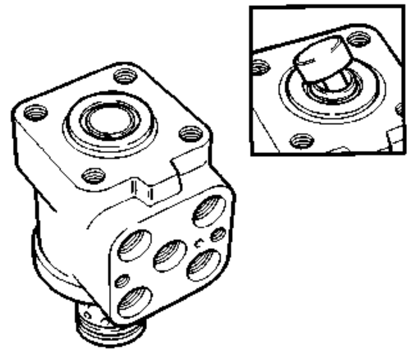
4. Lower steering unit body and tool sleeve over tool spindle until plastic bush is flush with end of bore. Assemble sleeves **12** and **15** with cross pin **14** and centring springs **13**. Fit bearing components **16** to **19** with chamfered face of **17** facing away from bearing **18**.



S229680

5. Remove body from tool leaving plastic bush in position, and lower body over assembled spool.

6. Apply downward pressure on body until plastic boss is forced out of bore, leaving seals correctly located.

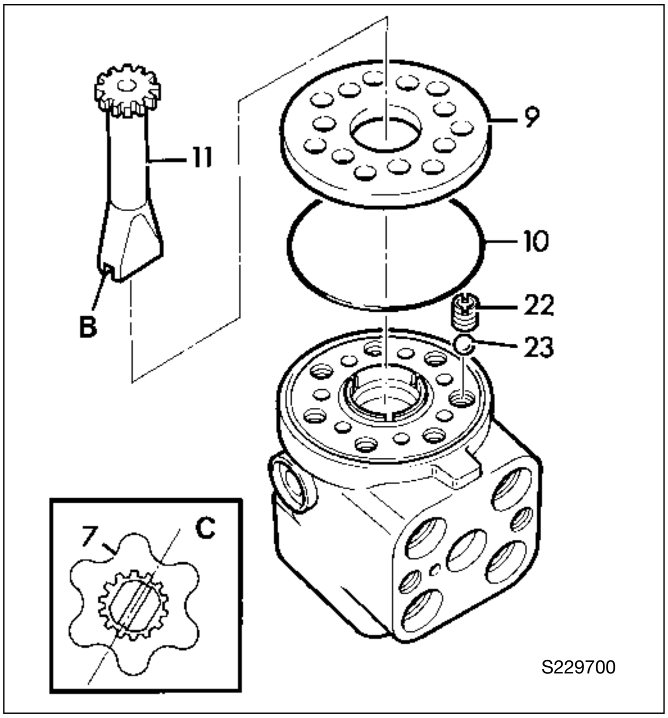

S229690

Assembly (Continued)

7 Invert unit and place on a suitable hollow support so that body does not rest on protruding sleeve, thus preventing displacement of the new seals. Place ball **23** into check valve hole and fit bush **22**.

8 Fit new 'O' ring **10**.

9 Fit distributor plate **9** ensuring that holes align. Locate shaft **11** onto cross-pin **14**, noting position of slot. When rotor **7** is fitted, slot must align with hollows of rotor as shown at **C**.



S229700

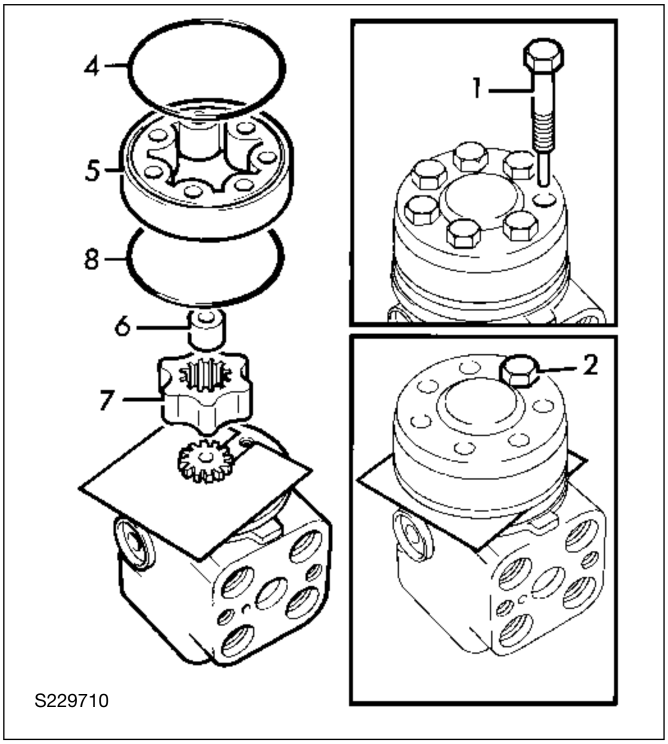
10 Use a suitable piece of rigid flat material, 0.25mm (0.010 in.) thick, to support the shaft and ensure positive engagement with the splines of rotor **7**.

11 Locate rotor onto shaft, ensuring alignment as at **C**. Fit spacing bush **6** into rotor.

12 Fit 'O' rings **4** and **8** each side of body **5**, then position body over rotor.

13 Refit the end plate and fit at least one bolt **2** before removing support material.

14 Fit remaining bolts, ensuring that special bolt **1** is correctly located. Tighten all bolts to 29Nm (22 lbf ft).



S229710

Pressure Relief Valve Cartridge

After renewing the 'O' ring, torque tighten the cartridge to 50 Nm (37 lbf ft). The relief valve is preset, refer to **Technical Data** for the valve setting. The relief valve setting should be rechecked after fitting the steering unit to the machine, refer to **Service Procedures - Steer System Pressure Testing**.

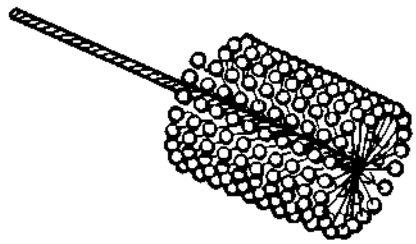
Shock Valves

If the shock valves have been dismantled, clean the threads of adjusting screw **31** and the threads in the bore of the steering unit body using JCB Cleaner/Degreaser, allow to dry. Assemble seat **35**, ball **34**, cap **33** and spring **32** then coat threads of screw **31** with JCB Threadlocker and Sealer. Assemble screw to depth measured during dismantling then fit plug **29** and washer **30**.

Contents **Page No.**

892/00041 De-glazing Tool for Cylinder Bores (to assist bedding-in of new piston rings)

Note: For other engine tools refer to the Engine Service Manual.



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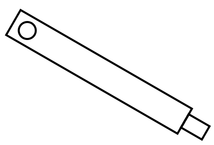

A314530

892/00956 Timing pin for fuel injection pump (AK, AM, AR)

	67 BHP	75 BHP
Type	1004-40AJ, naturally aspirated	1004-42AR, naturally aspirated
Build Number	AJ50686	AR50696
Number of cylinders	4	4
Bore	100 mm (3.937 in)	103 mm (4.055 in)
Stroke	127.0 mm (5.00 in)	127.0 mm (5.00 in)
Swept Volume	3.99 litres (243 in^3)	4.23 litres (258 in^3)
Compression Ratio	17.25:1	18.5:1
Compression Pressure	20 - 34 bar (300 - 500 lbf/in^2)	20 - 34 bar (300 - 500 lbf/in^2)
Maximum variation between cylinders	3.5 bar (50 lbf/in^2)	3.5 bar (50 lbf/in^2)
Injection Sequence	1, 3, 4, 2	1, 3, 4, 2
Valve Clearance - Hot or Cold		
- inlet	0.20 mm (0.008 in)	0.20 mm (0.008 in)
- exhaust	0.45 mm (0.018 in)	0.45 mm (0.018 in)
Maximum Speed (no load)	2350 rev/min	2350 rev/min
Governed Speed	2200 rev/min	2200 rev/min
Idling Speed	800 rev/min	800 rev/min

Fuel System

Injection Pump Type	DP202	DP202
Injection Pump Setting Code	2644F103/JG/1/2350	2644G002/RG/2350
Injection Timing	3° BTDC Dynamic	3° BTDC Dynamic
Injection Setting Pressure	294 bar (4263 lbf/in^2)	294 bar (4263 lbf/in^2)
Lift Pump Type	AC Diaphragm	AC Diaphragm

Induction System

Air Cleaner Type	2 stage, dry element	2 stage, dry element
Max. Restriction (at which warning light operates)	559mm (22 in) H_20	559mm (22 in) H_20

Lubrication System

Oil Pump Type	Differential rotor, gear driven	Differential rotor, gear driven
Oil Pressure (hot) at maximum speed	280 Kpa (40 lbf/in^2)	207 Kpa (30 lbf/in^2)

Cooling System

Coolant Pressure	0.48 bar (7 lbf/in^2)	0.48 bar (7 lbf/in^2)
Coolant Temperature (normal)	85 - 90°C (185 - 194°F)	85 - 90°C (185 - 194°F)
Temperature Warning Light operates at	98°C (209°F)	98°C (209°F)

Note: For further details of the engine refer to Engine Service Manual 9806/2140.

	75 BHP
Type	1000 Series, naturally aspirated
Build Number	AA50525
Number of cylinders	4
Bore and Stroke	100 mm (3.937 in) x 127.0 mm (5.00 in)
Swept Volume	4 litres (243 in^3)
Compression Ratio	16.5:1
Compression Pressure	28 bar (400 lbf/in^2) [maximum variation between cylinders - 3.5 bar (50 lbf/in^2)]
Injection Sequence	1, 3, 4, 2
Valve Clearance - Hot or Cold	
- inlet	0.20 mm (0.008 in)
- exhaust	0.45 mm (0.018 in)
Maximum Speed (no load)	2320 - 2420 rev/min
Governed Speed	2200 rev/min
Idling Speed	750 rev/min

Fuel System

Injection Pump Type	C.A.V., D.P.A., mechanically governed
Injection Pump Setting Code	DM55L/1000/1/2420
Injection Timing	16.5° BTDC
Injection Setting Pressure	220 atm
Lift Pump Type	AC Diaphragm

Induction System

Air Cleaner Type	2 stage, dry element
Max. Restriction (at which warning light operates)	559mm (22 in) H_20

Lubrication System

Oil Pump Type	Eccentric rotor
Oil Pressure (hot) at maximum speed	2.0 bar (30 lbf/in^2) (minimum)

Cooling System

Coolant Pressure	0.48 bar (7 lbf/in^2)
Coolant Temperature (normal)	80-85 °C (176 - 185 °F)
Temperature Warning Light operates at	98 °C (209 °F)

Note: For further details of the engine refer to Engine Service Manual 9806/0100.